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APPENDIX A: DESCRIPTION OF MAJOR PROGRAMS AND FACILITIES

Appendix A describes programs, organizations, infrastructure, facilities, and future plans of the Lawrence Livermore National Laboratory (LLNL). It provides information on existing activities and facilities, as well as information on those activities anticipated to occur or facilities to be constructed in the reasonably foreseeable future. The purposes of this appendix are to:

- Present information that can be used to evaluate the *Site-wide Environmental Impact Statement for Continued Operation of Lawrence Livermore National Laboratory and Supplemental Stockpile Stewardship and Management* (LLNL SW/SPEIS) No Action Alternative, Proposed Action, and Reduced Operation Alternative

- Identify activities conducted at LLNL that are part of the Proposed Action

Figure A–1 illustrates how this appendix interfaces with other sections and appendices of this LLNL SW/SPEIS.

LLNL is a multiprogram laboratory operated by the University of California (UC) for the U.S. Department of Energy (DOE), National Nuclear Security Administration (NNSA). The LLNL mission is to ensure that the Nation's nuclear weapons remain safe, secure, and reliable and to prevent the spread and use of nuclear weapons worldwide (DOE 2003b). This mission enables LLNL to serve as a national resource of scientific, technical, and engineering capability with a special focus on national security.

LLNL conducts operations at the Livermore Site near Livermore, California, at Site 300 near Tracy, California, and at the Nevada Test Site near Las Vegas, Nevada. Limited activities are conducted at leased properties located near the Livermore Site. LLNL also occupies land leased by DOE for the Arroyo Mocho Pump Station located 6 miles south of the Livermore Site. Figure A–2 and Figure A–3 show the regional locations of the Livermore Site and Site 300 and their locations with respect to the cities of Livermore and Tracy.

This appendix provides an overview of the LLNL operations conducted at the Livermore Site and Site 300, including its research programs, a description of the basic infrastructure of the two sites, and information on the activities within major facilities. Detailed descriptions of operations are limited to selected facilities that: have potentially hazardous operations or inventories are representative industrial facilities or have operations unique to the site. Facilities are also discussed that are associated with waste management, security, health services, and emergency response and major new facilities that are currently under construction. Administrative buildings, office buildings, and most light laboratory buildings and nonlaboratory-type facilities without hazardous materials, are excluded from detailed descriptions.

Descriptions of the potential hazards and the typical waste streams and effluents generated are presented in this appendix, for each of the selected facilities.

Section A.1 provides a description of the major programs and organizations at LLNL. Section A.2 provides a description of the site infrastructure, selected facilities, and future plans of the Livermore Site, while Section A.3 describes those of Site 300. Section A.4 presents a number of tabular inventories of generated wastes, chemicals and radionuclides, high explosives, and criteria air pollutants for facilities at the two sites. In addition, Section A.4 includes figures showing waste management facilities at the Livermore Site and Site 300.

A.1 MAJOR PROGRAMS AND ORGANIZATIONS AT LAWRENCE LIVERMORE NATIONAL LABORATORY

A.1.1 United States Department of Energy and National Nuclear Security Administration Programs Supported by Lawrence Livermore National Laboratory

LLNL performs work in support of DOE (including NNSA); other government agencies such as the U.S. Department of Defense (DoD), Nuclear Regulatory Commission, U.S. Environmental Protection Agency (EPA), and U.S. Department of Homeland Security; and private industries through Work for Others projects. The majority of LLNL activities support five major DOE and NNSA programs: Defense Programs, Nuclear Nonproliferation, Environmental Management, Science, and Energy Efficiency. These programs, which are described below, fulfill their missions through arrangements with LLNL program and institutional support organizations, scientific and technical personnel throughout the federal government, other national laboratories, and universities and industries throughout the world. LLNL's organization, presented in Sections A.1.2 and A.1.3, is largely structured to support these programs.

A.1.1.1 *Defense Programs*

Defense Programs achieves national security objectives for nuclear weapons established by the President and assists in reducing the global nuclear danger by planning for and maintaining a safe, secure, and reliable stockpile of nuclear weapons and associated materials, capabilities, and technologies in a safe, environmentally sound, and cost-effective manner. The core functions of Defense Programs are as follows:

- Manage the Stockpile Stewardship Program, which encompasses operations associated with maintaining, refurbishing, surveilling, and dismantling the nuclear weapons stockpile; researching, designing, developing, simulating, modeling, and nonnuclear testing nuclear weapons; and planning, assessing, and certifying nuclear weapons safety and reliability.

- Manage the research, development, and computer simulation facilities that maintain the safety and reliability of the nuclear weapons stockpile in the absence of underground testing and ensure the capability for maintaining the readiness to test and develop new warheads, if required.

- Manage establishing and maintaining appropriate partnerships with other NNSA and DOE elements; external scientific, research, and development agencies; industry; and academia.

- Ensure, through close coordination with the DoD, that materials, capabilities, and technologies are available to support the production of certified components necessary to extend the lifetime of the nuclear weapons stockpile.

A.1.1.2 *Nuclear Nonproliferation*

Nuclear Nonproliferation enhances U.S. national security through a four-pronged strategy:

- Enhancing the capability to detect weapons of mass destruction, including nuclear, chemicals and biological systems

- Preventing and reversing the proliferation of weapons of mass destruction

- Protecting or eliminating weapons and weapons-useable material or infrastructure, and redirecting excess foreign weapons expertise to civilian enterprises

- Reducing the risk of accidents in nuclear fuel cycle facilities worldwide

A.1.1.3 *Environmental Management*

Environmental Management provides program policy development and guidance for the assessing and cleaning inactive waste sites and facilities and for waste management operations; develops and implements an aggressive applied waste research and development (R&D) program to provide innovative environmental technologies to yield permanent waste disposal solutions at reduced costs; and oversees the environmental restoration of contaminated facilities from various programs, once the facilities are determined to be surplus to their original mission.

A.1.1.4 *Science*

DOE's Office of Science manages programs in high-energy physics, nuclear physics, and fusion energy sciences. It also manages fundamental research programs in basic energy sciences, biological and environmental sciences, and computational science.

A.1.1.5 *Energy Efficiency*

Energy Efficiency programs strengthen America's energy security, environmental quality, and economic vitality in public-private partnerships that enhance energy efficiency and productivity and bring clean, reliable, and affordable energy technologies to the marketplace.

A.1.2 Lawrence Livermore National Laboratory Program Organizations

A.1.2.1 *Director's Office*

The Director's Office leads LLNL in applying its resources in computing, engineering, science, and technology to DOE's programs to maintain the U.S. nuclear weapons stockpile and reduce the international threats posed by weapons of mass destruction. The Director's office comprises the Office of the Deputy Director for Operations, the Office of the Deputy Director for Science and Technology, and the Laboratory Executive Officer.

Deputy Director for Operations

Working with the institutional support organizations, the Deputy Director for Operations has responsibility for ensuring all operational functions of LLNL and for developing policies and programs to support LLNL's mission and workforce, while promoting excellence in business practices, safety assurances, and facility management in compliance with regulatory and contractual requirements.

Deputy Director for Science and Technology

The Deputy Director for Science and Technology is responsible for overseeing the quality of science and technology in scientific and technical program disciplines. This includes management of the LLNL-directed R&D programs; the University Relations Program Office; the DoD Programs Office; and the Office of Planning, Policy, and Special Studies.

A.1.2.2 *Defense and Nuclear Technologies*

Defense and Nuclear Technologies (DNT) ensures the safety, reliability, and security of the U.S. nuclear stockpile without nuclear testing; develops advanced manufacturing and materials technologies to maintain the enduring stockpile; and assures the DOE complex of the safe dismantlement of retired weapons. Multidisciplinary teams apply expertise towards the development of technologies that reduce the U.S. vulnerability to terrorist nuclear threats, enhance the Nation's conventional defense, and support other national needs (LLNL 2002cf). DNT comprises AX-Division, B-Division, the Nuclear Materials Technology Program, and the Weaponization Program.

AX-Division

The AX-Division ensures national and global security by maintaining scientific and technical competence and leadership, in the absence of nuclear testing, in all aspects of thermonuclear weapons physics, design, and operation. This involves applying theoretical, computational, and experimental physics to a wide range of problems relevant to national defense and security. Efforts focus on astrophysics, atomic and nuclear physics, computational physics, fluid dynamics and turbulence, high-energy-density physics, radiation transfer, and particle transport.

B-Division

The B-Division integrates experimental and theoretical expertise in high explosive properties and materials science through the use of hydrodynamic testing. Extensive use will be made of the Nation Ignition Facility (NIF) when it becomes operational.

Nuclear Materials Technology Program

The Nuclear Materials Technology Program (NMTP) provides the overall management and strategic coordination for all LLNL special nuclear material (SNM) and tritium program elements and Superblock facility operations (NMTP 1999).

Weaponization Program

The Weaponization Program provides support for certification and life prediction, the Stockpile Life Extension Program, and information systems. This is accomplished by providing high quality data and assessment and by implementing improved tools and predictive technologies to identify stockpile issues. The objective of the Weaponization Program is to support continued confidence in the safety, performance, and reliability of LLNL's weapon systems in the U.S. nuclear stockpile.

A.1.2.3 *National Ignition Facility Programs*

The NIF Programs support NNSA's Stockpile Stewardship Program mission of ensuring that the Nation's nuclear weapons remain safe, secure, and reliable. The NIF experiments will access high-energy density and fusion regimes with direct applications to stockpile stewardship, energy research, science, and astrophysics (LLNL 2001w). The NIF Programs are comprised of the NIF Project, the Laser Science and Technology (LS&T) Program, and the Inertial Confinement Fusion (ICF) Program.

National Ignition Facility Project

The NIF is a key component of NNSA's Stockpile Stewardship Program. On the NIF, up to 192 laser beams will compress small targets to conditions where they will ignite and burn, allowing the study of physical processes at temperatures approaching 100 million degrees Celsius and 100 billion times atmospheric pressure. These conditions exist in the interior of stars and in nuclear weapons explosions. The experiments will help scientists sustain confidence in the nuclear weapon stockpile without nuclear tests as a unique element of NNSA's Stockpile Stewardship Program and will produce additional benefits in basic science and fusion energy.

Laser Science and Technology Program

The LS&T Program provides advanced solid-state laser and optics technologies to LLNL, government, and industry to support national needs. The primary activities of the LS&T Program in recent years have been to complete laser technology development and laser component testing for the NIF project, develop advanced solid-state laser systems and optical components for DoD and DOE, and address the needs of other government agencies and U.S. industry.

Inertial Confinement Fusion Program

The ICF Program advances research and technology development in areas of fusion target theory and design, target fabrication, target experiments, and laser and optical science and technology. The mission of the ICF Program is to execute high-energy density physics experiments for the Stockpile Stewardship Program in order to demonstrate controlled thermonuclear fusion in the laboratory. Technical capabilities provided by the ICF Program also contribute to other DOE missions, including nuclear weapons effects testing and developing inertial fusion power.

A.1.2.4 *Nonproliferation, Arms Control, and International Security*

Nonproliferation, Arms Control, and International Security (NAI) provides technology, analysis, and expertise to aid the U.S. Government in preventing the spread of weapons of mass destruction (WMD) and in defending the U.S. against the use of such weapons. The major NAI programs include Proliferation Prevention and Arms Control, Proliferation Detection and Defense Systems, Counter-terrorism and Incident Response, International Assessments, and Center for Global Security Research.

Proliferation Prevention and Arms Control

The Proliferation Prevention and Arms Control Program focuses primarily on integrating treaty-monitoring technology R&D with policy analysis to support U.S. arms control efforts. Major program areas are supporting arms control, monitoring worldwide nuclear explosions, protecting and controlling nuclear materials, disposing of fissile material, and collaborating with former Soviet Union weapons scientists.

Proliferation Detection and Defense Systems

The Proliferation Detection and Defense Systems Program concentrates on proliferation detection and reversal by integrating LLNL capabilities in weapons design to identify signatures of proliferation-related activities and to develop remote and onsite monitoring technologies to detect those signatures. Major program areas are counter-proliferation analysis, proliferation detection systems, tactical systems, and missile and nuclear technology.

Counter-terrorism and Incident Response

The Counter-terrorism and Incident Response Program focuses on the response phase, including responding to incidents involving WMD. LLNL develops technologies and capabilities to deal with WMD emergencies or terrorist incidents. This program also serves as the focus for local, national, and international emergency response to WMD incidents. Major program areas are nuclear threat assessment, nuclear incident response, chemical and biological detection technologies, and forensic science.

The Forensic Science Center focuses on chemical, nuclear, and explosives counter-terrorism. It provides chemical and analytical science and support to the NAI, as well as to other LLNL and national sponsors.

The multidisciplinary staff provides expertise in organic and inorganic analytical chemistry, nuclear science, biochemistry, and genetics, useful for supporting law enforcement and for verifying compliance with international treaties and agreements.

International Assessments

The International Assessments Program addresses the need to avoid surprise regarding the weapons programs of foreign countries. LLNL conducts analyses and research related to the development and deployment of WMD by countries, states, and groups hostile to the U.S. These assessments provide important input to policy makers and diplomats as they develop strategies for U.S. responses to events affecting national and international security. Major program areas are nuclear weapons states, export control, emerging threats, counterintelligence, and proliferation concerns around the world.

Center for Global Security Research

The Center for Global Security Research brings scientists and technologists together with analysts and others from the policy community to study ways in which technology can enhance national and international security. This program supports independent, multidisciplinary research that considers the integration of technology in defense, arms control, nonproliferation, and peacekeeping. Major program areas are reduction in the threats associated with WMD, security implications of emerging technologies, anticipation and management of threats to international security, and future roles of deterrence and military force.

A.1.2.5 *Homeland Security Organization*

LLNL announced the formation of the Homeland Security Organization on December 10, 2002 (LLNL 2002u). The Homeland Security Organization will be the center for LLNL interactions with the Federal Government's Department of Homeland Security. Initially, this organization will be responsible for those LLNL activities explicitly transferred from NNSA to the new Department. Homeland Security at LLNL is divided into six programs: Chemical and Biological Countermeasures, Nuclear and Radiological Countermeasures, Systems Analysis and Studies, Information Analysis and Infrastructure Protection, Border and Transportation Security, and Emergency Preparedness and Response.

Chemical and Biological Countermeasures

This program focuses on addressing the national needs for technologies to quickly detect, identify, and mitigate the use of chemical and biological threat agents against the U.S. civilian population. The principal program is the Chemical and Biological National Security Program, within which are several notable projects, including the Biological Aerosol Sentry and Information System Project, Autonomous Pathogen Detection System, Advanced Biodetection Technology, Biological Signatures, the Forensic Science Center, In situ Chemical Sensors, and Remote Chemical Sensing.

Nuclear and Radiological Countermeasures

The Nuclear and Radiological Countermeasures Program focuses on developing technical capabilities aimed at countering the threat of terrorist use of a nuclear or radiological device in or near a U.S. population center, or from detecting and tracking nuclear material to forensic attribution in the event of a nuclear incident. Projects include nuclear emergency response, cargo container security, radiation detection, and detection and tracking systems.

Systems Analysis and Studies

This program focuses on identifying and understanding gaps in U.S. preparedness and response capabilities and the associated opportunities for technology. Systems studies are conducted to evaluate the effectiveness of alternative approaches to mitigating the damage and disruption resulting from a full range of catastrophic terrorist threats. Elements of this program include homeland security analysis, vulnerability assessment of the U.S. energy infrastructure, and outreach to operation entities.

Information Analysis and Infrastructure Protection

This program is aimed at developing tools and capabilities for gathering, manipulating, and mining vast quantities of data and information for the purpose of detecting early warnings of terrorist intentions. The program consists of the Computer Incident Advisory Center, operated as DOE's cyber alert and warning center; the Information Operations and Assurance Center; International Assessments; and Nuclear Threat Assessment.

Border and Transportation Security

Activities in this area address opportunities for technology to enhance U.S. border and transportation security, from nuclear detection systems for maritime and air cargo and automated facial screening of airline passengers, to integrated data management systems for immigration and border control. Projects supporting this program include concrete-penetrating radar, baggage-screening technologies, and truck-stopping devices.

Emergency Preparedness and Responses

This program focuses on the development of technical capabilities for minimizing the damage and recovering from any terrorist attacks. The program works with local, regional, state, and Federal first responders to ensure that the tools developed meet real-world needs. This program includes: the National Atmospheric Release Advisory Center (NARAC), a leader in real-time assessment of the atmospheric dispersion of radionuclides and chemical and biological agents; Joint Conflict and Tactical Simulation (JCATS); and the Homeland Operational Planning System, developed in partnership with the California National Guard, for homeland security and analysis.

A.1.2.6 *Energy and Environment*

Energy and Environment performs research in water and environment, energy technology, carbon management and climate change, the national nuclear waste repository, and aspects of homeland and national security. Energy and Environment also provides discipline support in atmospheric, earth, environmental, and energy science to other LLNL programs. The six programs in Energy and Environment are described below.

Carbon Management and Climate Change Program

The Carbon Management and Climate Change Program includes research in the areas of climate science, the carbon cycle, carbon management, and the interrelationships between the fate and effects of carbon in the biosphere, atmosphere, ocean systems, and climate change. Research areas include the DOE Program for Climate Model Diagnosis and Intercomparison; DOE's Atmospheric Radiation Measurement Program; programs in atmospheric chemistry; climate research, especially involving the coupling of models to carbon and the increase in model resolution; and carbon management, including research into ocean carbon sequestration, geologic sequestration, and carbon monitoring.

Energy Technology and Security Program

The Energy Technology and Security Program conducts R&D in fossil, renewable, and nuclear energy technologies to increase the efficiency of existing energy technologies while minimizing environmental impact and developing environmentally responsible technologies.

One project is DOE's Highly Enriched Uranium Transparency Implementation Program, which monitors the down-blending of highly enriched uranium from Russian nuclear weapons to low enriched uranium that is sold to the U.S. Examples of other projects include developing solid oxide fuel cells, reducing aerodynamic drag of heavy vehicles, researching homogeneous charge compression ignition engines, and researching the cryogenic storage of hydrogen.

National Security Support Program

This program supports LLNL's mission through research, development, and engineering as it relates to homeland security, weapons programs, stockpile stewardship, nonproliferation, international assessment, and defense-oriented program areas. This program identifies, coordinates, and applies science and technology in the areas of earth, atmospheric, and environmental monitoring; risk assessment; data fusion; energy propagation in complex materials; earth system modeling and simulation; and energy technologies.

Risk and Response Management Program

This program includes research and technology development in systems safety, systems security, natural and anthropogenic hazards, and atmospheric release assessment and modeling. The program includes atmospheric release assessment programs for predicting and assessing the dispersal of hazardous material released into the atmosphere, which also encompasses the NARAC; security and protection programs to enhance human vigilance, decision-making, and control through automation; and risk and safety management, which includes performing risk and hazard assessments, evaluating packaging and transportation safety, and providing regulatory support to government agencies.

Water and Environment Program

This program covers research and development in water security, environmental fate and transport, environmental technologies, and environmental consequence analysis. This program includes work performed by the Center for Accelerator Mass Spectrometry (CAMS); the Marshall Islands Dose Assessment and Radioecology Program, at atolls in the Pacific Ocean contaminated with nuclear fallout from earlier weapons testing; water security projects to protect the nation's water supplies and distribution systems; projects for protection from global environmental threats; and projects addressing issues of the fate, transport, and consequences of contamination in the environment.

Yucca Mountain Program and Repository Science Program

This program includes materials testing and performance modeling of the storage canister and system of engineered barriers to surround radioactive waste and supports project milestones toward the repository's license application. This program also includes work on international repository initiatives.

A.1.2.7 *Biology and Biotechnology Research*

The Biology and Biotechnology Research Program (BBRP) conducts basic and applied research in the health and life sciences in support of national needs to understand causes and mechanisms of ill health, develop biodefense capabilities for national homeland security, improve disease prevention, and lower health-care costs. BBRP work is focused on the following five scientific areas (LLNL 2002an):

- **Biodefense** – Provides the underpinning science and tools needed to combat bioterrorism and infectious disease.
- **Computational and Systems Biology** – Develops a predictive, systems level understanding of biological processes by applying advanced simulation capabilities to complex experimental data.
- **Genome Biology** – Increases understanding of genetic structure, function, regulation and evolution through genome scale approaches to developing, interpreting, and displaying genetic data.
- **Health Effects Genetics** – Increases understanding of the cellular and tissue effects of radiation chemical exposures through novel genomic- and biochemical-based approaches and links this understanding to risk assessments, diagnoses, and treatments.

- **Molecular Biophysics** – Develops and applies tools for measuring biochemical and cellular components and processes, emphasizing data that support predictive understanding through complex simulation and modeling.

A.1.2.8 *Physics and Advanced Technologies*

The Physics and Advanced Technologies' (PAT) Program's focus areas include high-energy density physics, astrophysics, condensed matter physics, and nuclear particle and accelerator physics. Program focus areas also include fusion energy, medical technology, imaging and advanced detectors (LLNL 2002bh). The major facilities supporting experimental research include the Ultra-Short Pulse Laser Facility, a two-stage light-gas gun facility, 100-million-electron volt electron-positron linear accelerator, the Electron Beam Ion Trap Facility, and the Experimental Test Accelerator II Facility. To carry out its mission, the PAT is organized into three groups: Physical Data Research, Laboratory-Directed Research and Development (LDRD), and License- and Royalty-Funded Research and Development.

Physical Data Research Program

The Physical Data Research Program provides validated physical data and models for the Stockpile Stewardship Program in the areas of nuclear physics, atomic physics, condensed matter/materials science, plasma physics, and the interaction of radiation with matter.

Laboratory-Directed Research and Development Program

The LDRD Program provides a suitable method for LLNL directors to fund projects that are creative and innovative, but that might not otherwise receive funding via the usual process. LDRD activities are governed by DOE O 413.2A and other NNSA Headquarters and NNSA Livermore Site Office guidance. Recently, responsibility for the LDRD Program has been transferred to the Laboratory Science and Technology Office.

License- and Royalty-Funded Research and Development Program

The License- and Royalty-Funded Research and Development Program provides private funding for R&D through cooperative research and development agreements (CRADAs) and licensing technologies developed by LLNL. A CRADA is an agreement entered into between the University of California, as operator of LLNL, and one or more participants including at least one non-federal party under which LLNL provides personnel, services facilities, equipment, or other resources towards the conduct of specified Research and Development.

A.1.2.9 *Chemistry and Materials Science*

Chemistry and Materials Science (CMS) provides scientific and technical expertise supporting LLNL's programs, performs work for others under reimbursable contracts, and conducts original research. R&D activities include chemical analysis and characterization, advanced materials, metallurgical science and technology, surfaces and interfaces, energetic materials and chemical synthesis, and energy-related projects. CMS contains three divisions: Chemical Biology and

Nuclear Science Division, Chemistry and Chemical Engineering Division, and Materials Science and Technology Division.

Chemical Biology and Nuclear Science

The Chemical Biology and Nuclear Science Division performs applied research in radiochemistry, radiation detection and spectroscopy, mass spectrometry, biochemistry, and analytical chemistry to support LLNL programs. The division also conducts fundamental research in several areas including computational biology, deoxyribonucleic acid (DNA) detection and single cell proteomics, heavy element research, noncovalent interactions among biomolecules, transport of actinide colloidal complexes in groundwater, cycling of iodine in the environment, isotopically enhanced molecular targeting, and nanophotonics.

Chemistry and Chemical Engineering

The Chemistry and Chemical Engineering Division conducts fundamental and applied research in chemistry under extreme conditions and on energetic materials and provides chemical engineering in support of national security programs. The division also provides chemistry and chemical engineering support to LLNL programs, including optics development for the NIF, high explosives and energetic materials development for the Stockpile Stewardship Program, and foreign threat assessments and capabilities for development of WMDs.

Materials Science and Technology

The Materials Science and Technology Division conducts fundamental and applied research with a focus on materials properties and performance under extreme conditions. The division also provides metallurgy, ceramics, electrochemical processing, materials science, material characterization, surface science, solid-state chemistry, and materials theory and modeling support to LLNL programs.

A.1.2.10 *Engineering*

Engineering contains two distinct disciplines: Electronics Engineering and Mechanical Engineering. Engineering also operates five technology centers.

Electronics Engineering

Electronics Engineering is responsible for the design and development of the core technologies needed for the development of microtechnologies, laser systems and electro-optics, pulsed-power electronics, diagnostic instrumentation, and advanced computational modeling and simulation. This division also provides instrumentation services, electronics fabrication, design drafting and documentation, computer systems support, and communications systems.

Mechanical Engineering

Mechanical Engineering provides a wide range of design, analysis, fabrication, and testing services to support LLNL programs. This group tests and evaluates engineering materials, designs and develops new experimental hardware and machine tools, fabricates parts, and inspects and assembles mechanical components.

Engineering Technology Centers

Engineering's five technology centers explore future innovations in computational engineering, microtechnology, precision engineering, nondestructive characterization, and complex distributed systems. The centers are responsible for the viability and growth of the core technologies each represents, including designing and building complex instruments and machines ready for production, designing and helping construct most of LLNL's unique test facilities, and conducting research in advanced, broad-application technologies for application across all LLNL programs (LLNL 2003g).

A.1.2.11 *Computation*

Computation provides integrated computing and information environments, scientific visualization facilities, high-performance storage systems, multi-resolution data analysis, scalable numerical algorithms, computer applications, and information management systems in support of LLNL missions and programs. Directorate missions include providing a balanced, seamless, high-performance computing environment that scales from desktop to petaflop; design, development, and delivery of integrated information systems and multidisciplinary applications; and development and implementation of software technologies to optimize software development and maintenance (LLNL 2003h). Computation is a key partner in the execution of the Advanced Simulation and Computing Initiative (ASCI). To carry out its mission, Computation is organized into three groups.

Integrated Computing and Communications

The Integrated Computing and Communications (ICC) group provides computing and networking environments to support stockpile stewardship computational efforts and a variety of other programs at LLNL. This group also undertakes essential computational, communication, and computer security research required to sustain this computing environment. Divisions in this group include High Performance Systems, Science and Development, Computer Systems Support, and Networks and Services.

Computing Applications and Research Department

The Computing Applications and Research (CAR) Department partners with other LLNL programs to develop software technologies and application codes in support of NNSA's mission in the defense, energy, and life sciences. This organization also conducts collaborative R&D in computer science, mathematics, and scientific computing focused on the long-term needs of LLNL and NNSA programs.

Chief Information Officer

The Chief Information Officer for the Computation Directorate provides oversight for information technology (IT) at LLNL. Of chief concerns are maximizing common IT solutions for economy of scale and uniformity of purpose; providing IT solutions; and interacting with DOE, NNSA, and the U.S. Office of Management and Budget on regulatory issues in security, information architecture, and e-government initiatives.

A.1.3 Lawrence Livermore National Laboratory Institutional Support Organizations

A.1.3.1 *Administration and Human Resources*

Administration and Human Resources is responsible for executing the policies affecting LLNL personnel and administrative support functions. Its mission is to promote initiatives that develop and retain a high-quality workforce and create an environment that enhances LLNL's performance. The Directorate includes Human Resources; Office of Strategic Initiatives and Diversity; Financial/Facility Manager; IT and Projects Office; Staffing and Employment Development; Compensation, Benefits and Worklife Programs; Office of Laboratory Council; Public Affairs; Audit and Oversight; Office of Contract Management; and Industrial Partnerships and Commercialization.

A.1.3.2 *Laboratory Services*

Laboratory Services manages a major segment of LLNL infrastructure and provides services in the areas of administrative information systems, plant engineering, procurement and material, innovative business and information services, utilities, and telecommunications systems.

A.1.3.3 *Safeguards and Security Organization*

The Safeguards and Security Organization is responsible for protective force operations; information and personnel security, including clearances, badging, and information and security awareness; physical security systems, alarm design, installation, and maintenance; and program planning for policy, risk management, audits and inspections, order compliance, and contract performance.

A.1.3.4 *Safety and Environmental Protection*

Safety and Environmental Protection supports LLNL programs and employees by providing resources and services to meet its objectives of environmental protection, occupational health, employee safety, emergency response, and quality assurance. Safety and Environmental Protection is divided into three departments to manage operational activities: Environmental Protection, Hazards Control, and Health Services.

Environmental Protection

The Environmental Protection Department is responsible for environmental restoration, environmental monitoring, environmental regulatory compliance, and hazardous waste management.

Hazards Control Department

The Hazards Control Department is responsible for minimizing the risks associated with research and support activities at LLNL. This includes biological, chemical, and physical agents and radioactive and industrial hazards associated with both normal operating conditions and emergencies.

Health Services Department

The Health Services Department provides LLNL personnel with onsite medical treatment for urgent drop-in services, personal counseling, health-risk evaluations, medical surveillance, and library services, to help each employee achieve personal health.

A.2 LIVERMORE SITE

The Livermore Site is located about 40 miles east of San Francisco at the southeast end of the Livermore Valley in eastern Alameda County, California. The city of Livermore's central business district is located about 3 miles to the west. The Livermore Site occupies a total area of approximately 1.3 square miles (821 acres). Figure A–2 and Figure A–3 show the regional location of the Livermore Site and its location with respect to the city of Livermore.

Additionally, LLNL conducts limited activities at various offsite properties near the Livermore Site. These include a childcare facility at the Almond Avenue Site in Livermore; a storage warehouse/shop at Graham Court in the city of Livermore used for equipment component storage and for the assembly of laser components; a storage warehouse on Patterson Pass Road in Livermore for receiving and storing the NIF components; and Arroyo Mocho Pump Station, located 6 miles south of the Livermore Site as the primary source of water supply. These nearby offsite properties are shown in Figure A–3. These properties are considered part of the Livermore Site for purposes of discussion in this appendix.

Although LLNL conducts some operations at the Nevada Test Site, these operations are covered in separate *National Environmental Policy Act* documentation for that site and are not addressed in this LLNL SW/SPEIS.

A.2.1 Existing Infrastructure

Infrastructure that supports Livermore Site's operation includes drainage, parking, pathways, telephones, lighting, landscaping, roads, and utilities. LLNL will continue to maintain, expand, and upgrade this infrastructure under the alternatives described in Chapter 3 of this LLNL SW/SPEIS. Figures A.2.1–1 and A.2.1–2 illustrate the site map and major roadways. Utilities serving the Livermore Site include domestic water, low-conductivity cooling water, demineralized water, compressed air, natural gas, sanitary sewer, and electric power. These utilities are described below.

- The primary source of water at the Livermore Site is the city of San Francisco's Hetch Hetchy Aqueduct, located 6 miles south of the Livermore Site at the Arroyo Mocho Pump Station. Water is pumped 850 feet to the surface by three pumps (two active and one standby) at the rate of 1,500 gallons per minute per pump. This water flows by gravity through a pipeline to storage tanks located at the southern end of the Sandia National Laboratories, California, site. Both the Livermore Site and Sandia National Laboratories, California, are gravity-fed from these tanks. In addition to LLNL's main water supply from Hetch Hetchy, LLNL has contracted with the Alameda County Flood Control and Water Conservation District for emergency water supply. In 2002, the Livermore Site used approximately 1.2 million gallons per day of domestic water (DOE 2003b).

- Low-conductivity cooling water is used for the cooling systems of buildings and equipment. It recirculates in a closed-loop system. The average daily cooling energy used in 2002 was 42.7 megawatts (DOE 2003b).

- Demineralized water is generated onsite from domestic water. The average daily load in 2002 was 20,160 gallons (DOE 2003b).

- Compressed air is generated onsite. Average use in 2002 was 2,400 cubic feet per minute (DOE 2003b).

- Natural gas is supplied at a pressure of 60 pounds per square inch by the Pacific Gas & Electric Company. Peak use in 2002 was 18,700 therms per day (DOE 2003b).

- Sanitary sewer discharge goes to the city of Livermore Water Reclamation Plant. A sewer-diversion facility is used to protect against the release of accidentally contaminated sewage to the city of Livermore treatment facilities. In 2002, peak sewer discharges, including discharges from Sandia National Laboratories, California, were 260,000 gallons per day (DOE 2003b).

- Electric power is supplied by Pacific Gas & Electric Company's Tesla substation and Western Area Power Administration's Greenville substation. Electric power is distributed throughout LLNL at 13.8 kilovolts. In 2002, the system load was 57 megawatts (DOE 2003b).

A.2.2 Existing Facilities

The facilities located at the Livermore Site are shown in Figure A.2.1–1. The descriptions of existing facilities are limited to selected facilities. Facilities were selected because they have potentially hazardous operations or inventories, they are representative industrial or shop facilities, or they have operations unique to the site. Facilities associated with waste management, security, health services, and emergency response are also briefly described.

The selected facilities at the Livermore Site are described in Sections A.2.2.1 through A.2.2.59, and are listed in Table A.2.2–1, with information on area, use, and the principal types of hazards present. Hazards are indicated as radiological, chemical, or other. Examples of radiological hazards include low-level ionizing radiation. Examples of chemical hazards include chemicals that may be toxic, flammable, corrosive, poisonous, and/or carcinogenic. Examples of other hazards include high explosives, non-ionizing radiation, biological, the storage and handling of compressed gas cylinders, and electrical hazards. Figure A.2.2–1 highlights the selected facilities. An overview of all other facilities is included in Table A.2.2–2. Several facilities described in the *Final Environmental Impact Statement and Environmental Impact Report for Continued Operation of Lawrence National Laboratory and Sandia National Laboratories* (1992 LLNL EIS/EIR) (LLNL 1992a) have been demolished or removed. Facilities that have been demolished or removed are highlighted in Figure A.2.2–2.

Each selected facility is described with location, square footage, and operations; hazards assessment; and generated wastes and effluents. For a more detailed discussion on waste generation and waste management, please refer to Appendix B, Waste Management.

A.2.2.1 *Building 121*

Building 121 is located in the southwest quadrant of the Livermore Site. Prior to 2002, this 91,145-gross-square-foot facility contained machine shops, laboratories, and offices. With the exception of one machine shop, all laboratory and machine shop operations in Building 121 have been removed and the space has been converted to offices for the NAI Directorate. The one remaining machine shop is inactive and scheduled for decommissioning in the near future (LLNL 2002bh).

Hazards Assessment

General industrial hazardous operations in this facility are associated with decommissioning powered machine tools and include using solvents, oils, regulated metals, and compressed gases (LLNL 2002bh).

Generated Wastes and Effluents

Hazardous waste and nonhazardous waste produced during decommissioning of the machine shop would include spent halogenated and nonhalogenated solvent solutions (both organic and inorganic), petroleum and mineral-based oils, empty containers, metal filings, and contaminated equipment (LLNL 2002bh).

A.2.2.2 *Building 131*

Building 131, the Engineering Facility, is located in the southwest quadrant of the Livermore Site. The 287,192-gross-square-foot facility comprises of an office wing and a high bay. The office wing contains approximately 500 offices and 5 shops and laboratory spaces. The high bay includes 34 industrial shops or laboratories and 13 offices. The high bay is equipped with 20-ton cranes, an environmental test facility, low humidity laboratories, laboratories equipped with high-efficiency particulate air (HEPA)-filtered hoods or gloveboxes for doing work with radioactive and hazardous materials, a conventional machine shop for working nonhazardous and nonradioactive materials, and a materials management vault and other locations for storage of controlled items. Building 131 primarily supports the nuclear weapons program with fabrication, inspection, assembly, testing, storage, and specialized machining functions (LLNL 2000j).

Building 131 also houses laboratories and equipment to support the W80 Life Extension Program. Activities for this program include assembly/disassembly of test units, environmental testing of components and sub-assemblies, and visual/dimensional inspections, among other tasks.

Hazards Assessment

The Building 131 office wing is classified as a general industry facility and the high bay is classified as a low-hazard and radiological facility (LLNL 2002by). Hazardous materials used in the high bay include hazardous and corrosive chemicals and gases, combustible and toxic metals and metal compounds, sealed radioactive sources, radioactive materials, and very small quantities of specific classes of high explosives. Operations within the high bay involve lithium hydride, beryllium, and depleted uranium as well as flammable and combustible liquids and combustible and toxic metals (LLNL 2001x).

The handling and storage of hazardous and radioactive materials is authorized in the Building 131 High Bay Hazards Analysis Report and are controlled and monitored by a combination of computer-based inventory tracking systems. Quantities of hazardous materials in the immediate work area are limited to the minimum needed for each operation or experiment. The use of a hood or glovebox may be required if the operation could potentially release material into the workplace and result in environmental, safety, or health hazards.

Radiation sources are limited to the high bay area and include a few sealed sources and small neutron radiation generating devices. Small antistatic devices containing sealed sources are also used in the toxic material fabrication laboratories. The health and safety technician monitors radiation levels and checks for radioactive and hazardous material surface contamination.

Other potentially hazardous operations in the Building 131 high bay include the use of lasers and x-ray-generating equipment. Lasers are used for general research activities, alignment work, measurements of component systems, and machining of toxic materials. X-ray sources are used to calibrate diagnostic systems and characterize materials, components, or assemblies. Safety controls are in place to minimize the potential of personnel exposure to x-rays and lasers. These include enclosing x-ray tubes in steel cabinets, and including safety covers or guards on laser devices, and using interlocks and shielding devices for x-ray systems (LLNL 2001x).

Generated Wastes and Effluents

Hazardous wastes and nonhazardous wastes are produced in Building 131, including alkaline and acid solutions; lab-packed and bulk-waste chemicals; lab-packed spent halogenated and nonhalogenated solvent solutions, both organic and inorganic; laser dyes; reactive salts; uncured epoxies; petroleum and mineral-based oils; empty containers; laboratory debris such as contaminated paper and rags, protective clothing, glassware, plasticware, tubing and fittings, wood and metal parts, and HEPA filters contaminated with hazardous constituents, machine shop wastes; print shop wastes; photographic wastes such as fix, developer, bleach and flammable liquids; and waste oil, with trace gasoline, diesel, organics, and metals.

Operations in the Building 131 high bay also generate small quantities of low-level radioactive and mixed; i.e., hazardous and radioactive waste. The generation of mixed waste is minimized by the proper segregation of hazardous and radioactive wastes.

Hazardous, low-level radioactive, and mixed waste is identified, labeled, and accumulated at satellite accumulation areas within the facility. When ready for disposal, these wastes are identified, labeled, and packaged by the generator and/or the building Radioactive and Hazardous Waste Management (RHWM) technician then transferred directly to an RHWM facility for proper disposition.

Hoods, gloveboxes, and enclosures used to control dispersible uncontained radioactive or hazardous particulates are ventilated to the outside environment through HEPA filters. Various other exhaust systems are used to intermittently ventilate the paint spray booth, welding hoods, bead blasters, vacuum pump exhausts, laser cavities, and inert gas flush systems directly to the outside of the building. No hazardous or radioactive material is discharged into the sanitary sewer or storm drain systems. These liquid wastes are collected at the point of generation and managed through an RHWM facility.

A.2.2.3 *Building 132N*

Building 132N is located in the southwest quadrant of the Livermore Site. This building comprises approximately 204,559 gross square feet of offices, laboratories, and storage facilities. A number of programs and research activities are underway in the Building 132N laboratories including, but not limited to, general wet chemistry/synthesis, radiochemistry, analytical chemistry, surface science, biological analysis, nanoscale synthesis and characterization, and research with small quantities of energetic materials. The facility also houses the Forensic Science Center, which provides a comprehensive range of analytical expertise on issues related to nonproliferation, counter-terrorism, and domestic law enforcement. There is also a high bay area with common industrial hazards and a machine shop (LLNL 2002ap, LLNL 2000k).

Hazards Assessment

Hazards associated with Building 132N operations include ionizing and non-ionizing radiation, lasers, electrical hazards (high voltages), hazardous and toxic materials, explosives, and up to Risk Group 2 (RG-2) biological materials. RG-2 materials include agents associated with human disease that are rarely serious and for which preventative or therapeutic interventions are often available. Controls for these hazards are specified in integrated worksheets and facility and operational safety plans (LLNL 2002ap, LLNL 2000k).

Biological materials used in Building 132N include infectious agents; tissues, including blood; or other items such as sewage, which may contain biologically hazardous agents and the toxins produced by living organisms. Recombinant DNA work is also conducted in the facility (LLNL 2000k).

Generated Wastes and Effluents

Wastes that contain Risk Group 1 (RG-1) or RG-2 biological materials are managed as biohazardous wastes as a best management practice. All biological waste is transported to Building 361 to be autoclaved (steam sterilized).

The hazardous wastes generated include flammable solids and liquids, organics, biological wastes, radioactive wastes, corrosives, toxic metals, and laser dyes. Small amounts of both radioactive and mixed waste are generated in this facility. Waste materials are collected at satellite accumulation areas and then moved to a designated waste accumulation area. The building also has a laboratory wastewater retention system that is used to collect and retain dilute nonhazardous and nonradioactive rinsewaters from laboratories until analysis determines they can be discharged to the sanitary sewer. Many of the laboratories are equipped with exhaust hoods (LLNL 2002ap, LLNL 2001y).

A.2.2.4 *Building 132S Complex*

The Building 132S Complex is located in the southwest quadrant of the Livermore Site and comprises Buildings 132S, 134, and 135. This 168,715-gross-square-foot complex provides laboratory, office, shop, and storage facilities. Primary activities are biomedical technological research using laser technology and computer simulations, proliferation-detection technology systems, missile and nuclear technology, and mechanical and electronic fabrication shops (LLNL 2002aq).

Operations in the Building 132S Complex include laser experiments, sensor development, spectroscopy, gamma ray imaging, medical physics/biophysics, materials research, distillation and concentration of hydrogen peroxide/satellite fueling, and optical wave guide materials research (LLNL 2002bh, LLNL 2002aq).

Medical physics/biophysics research encompasses the development of advanced biosensors for counter-terrorism applications, participation in LLNL's pathomics project for developing new methods of infectious disease detection, development of advanced biomaterials and shaped memory polymers for use in medical devices, work on artificial organs, and creation of advanced imaging methods for applications in medicine and defense. It is anticipated that BioSafety Level 2 (BSL-2) controls, as specified in the Centers for Disease Control and Prevention *BioSafety in Microbiological and Biomedical Laboratories* guidelines, would be implemented at a future date (LLNL 2002bh).

Hazards Assessment

Hazards associated with Building 132S Complex operations include ionizing and non-ionizing radiation, lasers, electrical hazards (high voltages), hazardous and toxic materials, and RG-1 and RG-2 biological materials. Controls for these hazards are specified in both facility and operational safety plans (LLNL2002bh, LLNL 2002aq).

Hazards associated with medical physics/biophysics research include the handling, use, and storage of RG-1 biological materials. RG-1 materials include live agents or materials commonly used in research, university, college, and hospital settings. RG-2 materials include agents associated with human disease that are rarely serious and for which preventative or therapeutic interventions are often available. Associated laboratory equipment includes incubators, freezers, syringes, and biological safety cabinets. Associated hazards include cuts or needle-sticks from handling sharps, burns from handling hot objects or from ultraviolet light exposure, and laboratory-acquired infections from poor personal practices or poor housekeeping practices (LLNL 2002bh).

Hazards associated with materials research, distillation and concentration of hydrogen peroxide/satellite fueling, and optical wave-guide materials research include lasers, electrical hazards (high voltages), chemical hazards (concentrated hydrogen peroxide), flammables, and biological hazards (LLNL 2002bh, LLNL 2002aq).

Generated Wastes and Effluents

The types of waste produced by the medical physics and biophysics research include nonhazardous biological waste, biohazardous and contaminated sharps (medical) waste, and chemical waste. Biohazardous waste includes waste generated from research with RG-1 and RG-2 agents (LLNL 2002bh). All biohazardous wastes are autoclaved at Building B-361 (BBRP).

Hazardous waste and nonhazardous waste is produced in the Building 132S Complex, including alkaline and acid solutions; lab-packed and bulk-waste chemicals; lab-packed spent halogenated and nonhalogenated solvent solutions, both organic and inorganic; laser dyes; reactive salts; petroleum and mineral-based oils; empty containers; laboratory debris such as contaminated paper and rags, protective clothing, glassware, plasticware, tubing and fittings, wood and metal parts, and HEPA filters contaminated with hazardous constituent; machine shop wastes; print shop wastes; photographic wastes such as, fix, developer, and bleach and flammable liquids; and waste oil, with trace gasoline, diesel, organics, and metals (LLNL 2002bh).

A.2.2.5 *Building 141*

Building 141 is located in the southwest quadrant of the Livermore Site. The facility has a total area of 50,927 gross square feet and consists of offices, pulsed-power laboratories, an electromagnetics laboratory, a dielectric research area, machine shop operations, a detonator studies, a crystal growth laboratory, and technician workstations (LLNL 2000b). Planned additional uses of the facility include wet chemistry and biological laboratory operations.

Hazards Assessment

Building 141 is classified as a low-hazard facility. The hazards present in the facility are associated with flammable liquids; reactive, corrosive, carcinogenic, and pyrophoric materials; cryogens; high-voltage electrical systems; ionizing and non-ionizing radiation; toxic materials; lasers; and pulsed-power units (LLNL 2000b, LLNL 2002cs).

Numerous engineering and safety controls are in place. Laboratory practices involve minimizing the use and storage of chemicals as well as labeling and segregation of materials kept onsite. The hood and ventilation system consists of eight exhaust hoods. In the event of ventilation system failure, all work is stopped. Operations that require the use of high-voltage systems or that produce ionizing radiation are equipped with interlock systems to safeguard personnel from electric shock or radiation hazards (LLNL 2001z).

Detonators are stored in approved storage areas only, in a nonpropagating configuration. Detonator use is restricted to approved areas and these areas are electrically interlocked and equipped with physical key lockouts (LLNL 2002cs).

Generated Wastes and Effluents

Hazardous waste and nonhazardous waste is produced in Building 141, including alkaline and acid solutions; lab-packed and bulk-waste chemicals, lab-packed spent halogenated and nonhalogenated solvent solutions, both organic and inorganic; empty containers; laboratory debris, including contaminated paper and rags, protective clothing, glassware, plasticware, tubing and fittings, wood and metal parts, and HEPA filters contaminated with hazardous constituent; electronic manufacturing wastes; etching wastes; waste oil with trace gasoline, diesel, organics, and metals; discarded capacitors (potentially *Toxic Substance Control Act* [TSCA] wastes), and contaminated equipment such as vacuum pumps, ignition tubes, and other equipment. No radioactive, mixed, or transuranic waste is generated in the facility (LLNL 2001z).

Prior to 2001, Building 141 operated a wastewater retention tank system to support plating operations. The plating operations in Building 141 have been removed and wastewater is no longer discharged to or stored in this system. The system has been closed.

A.2.2.6 *Building 151 Complex*

The Building 151 Complex, located in the southwest quadrant of the Livermore Site, comprises Buildings 151, 152, 154, and 155 and various trailers. The complex has a total area of approximately 120, 218 gross square feet. Buildings 151 and 154 provide office, laboratory, and electronics shop facilities for laboratory operations in a broad range of chemical, radiochemical, and bio-analytical research. Primary activities include research in radiochemical chemical analysis, transport of radionuclides in geomaterials, preparation of radionuclides for experiments, analysis of environmental and waste samples, biological research and analysis, nanoscale synthesis and characterization, and clean room activities. Building 152 is used as a small chemical storage facility as well as an area for accumulating biological waste for transfer to the BBRP. Building 155 contains offices and an auditorium (LLNL 2002ap, LLNL 2000l).

Hazards Assessment

The primary hazards associated with the Building 151 Complex are biological, radiological, and toxicological. Controls for these hazards are specified in integration work sheets and facility and operational safety plans (LLNL 2002ap, LLNL 2000l). Biological materials used in the Building 151 Complex include infectious agents; tissues, including blood; or other items such as sewage and animals, which may contain biologically hazardous agents and the toxins produced by living organisms. Recombinant DNA work is also conducted in the facility.

Generated Wastes and Effluents

The hazardous wastes generated include corrosives, flammable organics, biological wastes, toxic metals, and radioactive and mixed wastes. Waste materials are collected at satellite accumulation areas and then moved to a designated waste accumulation area. Wastes that contain RG-1 biological materials are managed as biohazardous wastes as a best management practice. All waste containing RG-2 biological materials must be autoclaved prior to disposal. Wastewater, potentially contaminated with radionuclides, metals, and acids discharged to sinks or floor drains in chemistry laboratories or shops, is sent to the retention tank system. When full, the retention tanks are sampled. If the wastewater meets the sewer discharge criteria, it is released to the sanitary sewer. If it is unacceptable for release, it is transferred to an RHWM facility for treatment, storage, and/or disposal (LLNL 2002ap). Most laboratories are equipped with exhaust hoods that vent to the atmosphere, and some employ gloveboxes with HEPA filters for radiological work. The types of waste produced by the biological analysis and recombinant DNA research include nonhazardous biological waste, biohazardous and contaminated sharps (medical) waste, and chemical waste. Biohazardous waste includes waste generated from research with RG-1 agents not associated with disease in healthy human adults and RG-2 agents associated with human diseases that are rarely serious and for which preventative or therapeutic interventions are often available. All biological wastes are autoclaved by the BBRP at Building 361.

Hazardous and nonhazardous wastes are produced in the Building 151 Complex, including alkaline and acid solutions such as lab-packed solutions; lab-packed and bulk-waste chemicals; lab-packed spent halogenated and nonhalogenated solutions, both organic and inorganic; empty containers; laboratory debris, including contaminated paper and rags, protective clothing, glassware, plasticware, tubing and fittings, wood and metal parts, and HEPA filters contaminated with hazardous and or radioactive constituents; cleaning solutions, including solvents; rinsewater; sludge/water; waste oil with trace gasoline, diesel, organics, and metals; print shop wastes; photographic wastes; asbestos; and contaminated equipment such as vacuum pumps and other equipment.

A.2.2.7 *Building 153*

Building 153, the Microfabrication Laboratory, is located in the southwest quadrant of the Livermore Site. This 24,967-gross-square-foot laboratory consists of nine principal laboratory working areas, three dry laboratories, a clean room dressing area, and packaging and machine room areas. The Microfabrication Laboratory is used for micro-electronics fabrication operations, semiconductor opto-electronics, microfluidics electro-mechanical systems, and guided-wave photonics. Additional capabilities include material characterization and device testing capabilities, microscopic inspection, packaging, and electrical and optical testing of devices. Building 153 also houses the Micro-Technology Center's multidisciplinary team, which applies advanced engineering, physics, chemistry, and biology to the development of microfabricated optical, electronics, mechanical, and chemical devices to support LLNL's missions in national security, global ecology, biosciences, and national industrial competitiveness (LLNL 2001a, LLNL 2000m).

Hazards Assessment

Building 153 is classified as a low-hazard facility. The principal hazards are associated with use of various chemicals during the fabrication of silicon and gallium arsenide integrated circuits. Some of these chemicals include acids, bases, solvents, resins, phosphates, fluorides, iodides, and some toxic, pyrophoric, and reactive gases. Testing of microfluidic devices requires the use of small quantities of RG-1 or RG-2 biological agents. Wastes from this process are sterilized prior to disposal. Additional hazards within the facility include common industrial hazards, carcinogens, lasers, radio frequencies (RF), and x-rays (DOE 2001n).

Operations in Building 153 are controlled by the facility and operational safety plans. Operations involving biological materials up to RG-2 or hazardous materials require the use of personal protective equipment. Quantities of hazardous materials in the work area are limited to the minimum needed for each operation. The use of a hood is required if the operation could potentially release material into the workplace. Personnel safety is ensured by toxic materials storage and handling systems. Toxic gases are handled only in gas cabinets, and adequate ventilation and safety valves are provided for added protection (LLNL 2001a, LLNL 2000m).

Safety controls are in place to minimize the potential of personnel exposure to x-rays and lasers. These include enclosing x-ray tubes in steel cabinets, placing safety covers and guards on laser devices, and having interlocks and shielding devices (LLNL 2000m).

Generated Wastes and Effluents

The operations in Building 153 generate hazardous, nonhazardous, and RG-1 and RG-2 biological wastes. Hazardous wastes and nonhazardous wastes are produced in the facility and include alkaline and acid solutions; lab-packed and bulk-waste chemicals; lab-packed spent halogenated and nonhalogenated solvent solutions, both organic and inorganic; laser dyes; petroleum- and mineral-based oils; empty containers; laboratory debris such as contaminated paper and rags, protective clothing, glassware, plasticware, tubing and fittings, wood and metal parts, and HEPA filters contaminated with hazardous constituent; machine shop wastes; and flammable liquids.

Waste materials are collected at satellite accumulation areas and then moved to a designated waste accumulation area. Wastes that contain biological materials are managed as biohazardous wastes as a best management practice, which requires appropriate autoclaving before disposal.

Building 153 has an 8,000-gallon wastewater retention system that receives wastewater from the semiconductor operations. When full, the retention tanks are sampled. If the wastewater meets the sewer discharge criteria, it is released to the sanitary sewer. If it is unacceptable for release, it is transferred to an RHWM for treatment, storage, and/or disposal.

Some operations in Building 153 release small quantities of gases and organic vapors to the atmosphere. The gases from fume hoods feed into a 15-meter exhaust stack. Because the quantities of gases used are small, the release of gases under the worst-case condition will not exceed their respective Emergency Response Planning Guideline (ERPG) values (LLNL 2000m).

A.2.2.8 *Building 161*

Building 161 is a 6,119-gross-square-foot building in the west-central portion of the Livermore Site. It houses various research projects involving the development of laser technologies and the development of laser technology applications. The major research activity is the Advanced Materials Program involving the use of high-power tuned lasers to separate isotopes of several materials through the process of selective photo-ionization. The work scope includes generation of laser beams, delivery of the laser beam, preparation of the metallic feedstock, generation of the metallic vapor, separation and collection of the photo-ionized material, recovery of the separated metal, and diagnostic measurements of the laser isotope separator systems (DOE 2002o).

After conducting experimental runs to test and calibrate equipment, the Advanced Materials Program would relocate to Building 332 to conduct experiments using surrogate and other materials (DOE 2002o).

Hazards Assessment

Hazards include chemical hazards such as laser dyes, electrical hazards, laser beam and optical radiation hazards, x-rays (from e-beam vaporization), and general industrial hazards associated with powered machine tools, solvents, oils, and compressed gases (DOE 2002o).

Generated Wastes and Effluents

Building 161 generates a variety of waste streams. Such wastes may include hazardous, radioactive, and mixed waste. Hazardous constituents may include corrosive liquids, spent solvents, material with concentrations of regulated metals, laser dyes, and waste oils (LLNL 2002o).

A.2.2.9 *Buildings 162, 165, and 166*

Buildings 162, 165, and 166 are located in the northwest quadrant of the Livermore Site. These buildings provide laboratory and office space for various activities related to lasers. The buildings and their operations are summarized in Table A.2.2.9–1 (LLNL 2002ah).

TABLE A.2.2.9–1.—*Summary of Building Operations for Buildings 162, 165, and 166*

Facility	Uses	Square Feet
Building 162	Non-Linear Optics Lab, Crystal Growth Facility, laser materials development, advanced solid state lasers, non-linear optical materials development, x-ray (LAUE) diffraction of crystals, and Inertial Fusion Energy (IFE) Substrate Irradiation	19,840
Building 165	Laser Diode Fabrication Lab, Large Area Tester (LAT), KDP Crystal Optical Load Test System (COLTS), and Phoenix	8,347
Building 166	Pyrochemical Demonstration System, Hi-Brite laser demonstrator, and operation of the Metal Organic Chemical Vapor Deposition (MOCVD) system	10,864

Source: Original.

Hazards Assessment

Hazards within these facilities are associated with high voltages, x-ray radiation, exposure to laser beams, chemical reactions, toxicity to materials, pyrophoric metals, toxic gases, caustic chemicals, acid burns, and fire. Facility safety features are provided to reduce the hazards, providing multilevel protection against accident or injury to operational personnel (LLNL 2002ah).

Generated Wastes and Effluents

There are many different types of hazardous and low-level radioactive wastes generated from this complex of buildings. The wastes include combinations of aluminum, arsenic, phosphorous, antimony, arsine, chlorides, and chlorine. Zinc and silicon may also be present in small amounts.

Wastes are generated from processes using aqueous solutions, acids, bases, halogen salts, gas scrubbers, and organic materials such as solvents and oils. Wastes from these processes are collected in designated containers in the satellite accumulation areas. There are no appreciable effluents generated from these facilities.

A.2.2.10 *Buildings 171, 173, 174, 174 Annex, 176, and 179*

The Building 170 series is located in the northwest quadrant of the Livermore Site. The buildings and their operations are summarized in Table A.2.2.10–1 (LLNL 2002bh).

TABLE A.2.2.10–1.—*Summary of Building 170 Series Operations*

Facility	Uses	Square Feet
Building 171	Dye Laser Development Lab, vacuum test unit, characterization of metal alloys in MINERVA[a] chambers, Dye Lab, Optical Loss Measurement Facility, helium-neon lasers, and waste accumulation area	8,632
Building 173	Machine shop/weld shop	413
Building 174	Laser target research	19,360
Building 174 Annex	Ultra Short Pulse Laser Facility	20,365
Building 176	Light duty machine shop, shipping and receiving	3,958
Building 179	Metrology laboratory, optical measurement tools, electron microscopy and atomic force microscopy; instrument alignment lab	2,720

Source: Original.
[a]A tool for analyzing and planning targeted molecular radiation treatment for cancer patients.

Hazards Assessment

Building 173 has the standard industrial hazards associated with machine shop usage. There are many hazards associated with the Building 174 and Building 174 Annex operations from the use of hazardous and radioactive materials including laser dyes; solvents; flammable liquids; and natural, depleted, or enriched uranium; cryogenic material; and beryllium. Personnel may be exposed to x-rays, high-power laser beams, high voltages, heat and skin burns, eye injuries, and overpressure of vacuum chambers. Laser hazards are mitigated by door interlocks, laser enclosures, and appropriate eyewear. All chemicals and radioisotope inventories are below regulatory threshold levels. General industrial operations in Building 176 are associated with powered machine tools, solvents and oils, and compressed gases. Chemicals found in Building 179 include cleaning compounds, small (<0.5 liter) quantities of ethanol, isopropyl alcohol, and acetone.

Generated Wastes and Effluent

Small amounts of hazardous waste may be generated from the operation of the Building 173 machine shop and would consist of waste commonly produced in industrial facilities, such as oils, cutting fluids, etc.

Building 174 and its annex generate wastes, including various hazardous and radioactive chemicals. Typical hazardous waste streams include spent solvents, waste oils, reactive metals, adhesives and epoxies, and regulated metals. Small amounts of radioactive and mixed waste may be generated from the use of radioactive targets. These wastes are generated in small quantities and are typical of waste generated in experimental laboratories.

Small amounts of hazardous waste may be generated from the operation of the Building 176 machine shop, consisting of waste commonly produced in industrial facilities, such as oils, cutting fluids, etc.

Small amounts of hazardous waste may be generated in Building 179 and would be typical of waste generated in small-scale R&D facilities.

Waste generated at these facilities is temporarily stored at the Building 171 waste accumulation area until transported to RHWM facilities for treatment, storage, and/or disposal.

A.2.2.11 *Building 190*

Building 190, the CAMS Facility, is located in the northwest quadrant of the Livermore Site. This 10,086-gross-square-foot building houses four accelerators ranging in size from 1.0^{-10} megavolts to 10 megavolts. Facility operations include accelerator mass spectrometry for cosmogenic and radiogenic isotopes and a nuclear microprobe for materials characterization. Current research activities emphasize bioscience, such as metabolism, cancer, and protein analysis, and earth and environmental sciences, such as climate change, hydrology, and atmospheric science (LLNL 2002bw).

Hazards Assessment

Hazards within the CAMS facility are typical of accelerator facilities and include ionizing radiation from ion sources, prompt radiation, and residual radiation induced in targets and shielding. Other hazards include high voltage, magnetic fields, and asphyxiants.

Administrative controls and mechanical and electronic safety devices are used to help mitigate these potential hazards. Administrative controls include monitoring for x-rays, radioactivity, and oxygen deficiency and requiring a hazard analysis for any new experimental project in the facility.

Engineering controls associated with operations in the CAMS facility include safety interlocks to limit personnel access to certain areas during operation, radiation shielding, protective equipment or clothing, automatic systems to monitor and limit the production of radiation, and various methods of warning personnel of the operation of experiments with potential hazards. Shielded areas previously used for accelerator research are locked up. Access is controlled by the facilities coordinator and the hazards control technicians assigned to those facilities where there is a potential for contamination (LLNL 2002bw).

Generated Wastes and Effluents

Building 190 generates small quantities of hazardous, radioactive, and mixed waste. Waste produced in the facility would include lab-packed spent organic solvents; empty containers; laboratory debris, such as contaminated paper and rags, protective clothing, glassware, plasticware, tubing and fittings, and wood and metal parts; and contaminated equipment. These wastes are collected in designated containers in the satellite accumulation areas (LLNL 2002bw).

A.2.2.12 *Building 191*

Building 191, the High Explosives Application Facility (HEAF), is located in the northwest quadrant of the Livermore Site. The building is 120,116 gross square feet and includes 13,000 square feet of office space. R&D activities at HEAF include studying intentional detonations, synthesizing and formulating materials, testing material properties and characterization, studying the physics of initiation, developing diagnostic methods and equipment, and conducting detonator surveillance. This facility was constructed to provide LLNL with a centralized high explosives research facility with modern diagnostic and testing equipment. Building 191 is currently LLNL's center for the study of chemical high explosives and their application to conventional explosive and nuclear device systems (LLNL 2002cp).

Hazards Assessment

Hazardous materials in Building 191 are used in high explosive synthesis and formulation, high explosive properties characterization, shock-loading experiments, detonation experiments, and various support shop operations. Hazard sources associated with HEAF operations include high-voltage power; toxic, reactive, flammable, and corrosive materials; asphyxiants; thermal flux; gravity-mass sources; lasers; ionizing and non-ionizing radiation; cryogenics; and compressed gases (LLNL 2002cp).

The main radiological hazards are associated with the x-ray machine and x-ray-computed tomography used to radiograph components and assemblies. These machines are heavily shielded with concrete to minimize radiation exposure. The other sources of radiation are the flash x-ray generators, which are used as diagnostic tools in some of the firing tanks. Detonation experiments are conducted in firing tanks that provide protection to the facility and personnel. One of the firing tanks was designed to be used for experiments using hazardous materials such as depleted uranium when the associated washdown system is completed and installed (LLNL 2002cp).

Generated Wastes and Effluents

The firing tank debris and high explosives chemistry operations are the two primary sources of potentially hazardous waste. The firing of gun propellants in one of the firing chambers generates water, carbon dioxide, and nitrogen. The wastes generated include high explosives, debris contaminated with high explosives, and high explosive residues. Smaller quantities of carbon monoxide and nitrogen oxides are also produced. Some of the residues may contain mutagenic compounds. Detonations of high explosives produce toxic gases.

Chemistry operations generate small quantities of solid, liquid, and gaseous wastes. The hazardous waste and nonhazardous waste that is produced in the facility includes alkaline and acid solutions, including lab-packed solutions,; lab-packed waste chemicals; spent halogenated and nonhalogenated solutions, both organic and inorganic; empty containers; laboratory debris, such as contaminated paper and rags, protective clothing, glassware, plasticware, tubing and fittings, wood and metal parts, and HEPA filters contaminated with hazardous constituents; flammable liquids; cleaning solutions, including solvents; waste oil with trace gasoline, diesel, organics, and metals; photographic wastes; test debris and residues; discarded capacitors (i.e., potentially TSCA wastes); and contaminated equipment such as vacuum pumps, ignition tubes, and other equipment.

Several photographic development laboratories in the HEAF generate spent photographic solution wastes. These wastes are collected in carboys. Rinsewater used in the process is discharged to the LLNL sanitary sewer system because previous samples have shown the concentrations of photographic chemicals are consistently far below acceptable release levels (LLNL 2002cp).

Airborne particulates from the firing tanks are channeled through air filter bags. HEPA filters are installed for the gun tank. Negative pressure hoods are located in all chemistry areas to exhaust effluent gases.

The wastewater retention system consists of two central, aboveground waste retention tanks. The two tanks are surrounded by a berm capable of containing the entire volume of both tanks. All rinsewater is collected in the waste retention system and sampled prior to discharge. This system is considered a nonhazardous system, and the tank's contents are routinely discharged to a sanitary sewer after sampling and analysis.

A.2.2.13 *Building 194*

Building 194, the Electron-Positron Linear Accelerator (LINAC) Facility, is a 42,031-gross square-foot facility located in the northwest quadrant of the Livermore Site. The LINAC Facility consists of a complex of aboveground and underground facilities. The 100-million-electron-volt electron-position linear accelerator, beam lines, and all operational experimental target areas are located underground for enhanced radiation shielding. The aboveground buildings include a modulator building, an office, laboratory, machine shop, and storage facilities. An aboveground neutron silo and an associated time-of-flight experimental area were decommissioned several years ago and are currently unused.

Ongoing research programs in Building 194 include experiments in fundamental nuclear, atomic, solid-state, plasma, and particle physics; fundamental experiments in laser-electron interactions; applied research in materials science; and development of diagnostic and analytical techniques for industrial applications. Building 194 also houses various laser development and experimental activities and the electron beam ion trap (EBIT) experiment. Major equipment in the facility includes two electron accelerators and several high-power, short-pulse lasers (LLNL 2002bh, LLNL 2002cq).

Hazards Assessment

The hazards associated with Building 194 include ionizing and non-ionizing radiation; lasers; hazardous materials such as cryogenic gases, asphyxiants, laser dyes, solvents, high explosives, and lead; vacuum; high-pressure gas; high-voltage; and machine shop-associated hazards.

Three types of radioactive materials are used in Building 194: sealed sources; plutonium samples, housed in a manner similar to a sealed source to prevent plutonium particles from being released; and items activated from accelerator operations. These activated equipment and building components, which are identified by surveying and are controlled accordingly, are not considered contaminated areas.

Administrative controls and mechanical and electronic safety devices are used to help mitigate these potential hazards. Administrative controls include personnel training; maintaining lists of qualified operators; tracking all shipments of hazardous or radioactive materials to ensure that limits are not exceeded; periodic or continuous monitoring for x-rays, radioactivity, toxicity, or oxygen deficiency; and requiring a hazard analysis for any new experimental project. Hazardous materials used and stored in Building 194, including cryogens, are used and stored in accordance with institutional and programmatic controls for minimizing or reducing the potential for exposure, injury, or illness. Controls for the hazards are specified in safety plans.

Engineering controls associated with operations in Building 194 include safety interlocks to limit personnel access to certain areas during operation, radiation shielding, personal protective equipment or clothing, protective storage cabinets or filtered hoods, automatic systems to monitor and limit the release of toxic gases or the production of radiation, and various methods of warning personnel of the operation of experiments with potential hazards. Shielded areas previously used for accelerator and/or nuclear physics research are locked up. Access is controlled by the facilities coordinator and the hazards control technicians assigned to those facilities where there is a potential for contamination (LLNL 2002cq).

Generated Wastes and Effluents

Wastes generated in this facility include hazardous, radioactive, and small amounts of mixed waste. Hazardous waste streams may include solvents, oils, corrosive liquids, high concentrations of regulated metals, and other industrial waste such as epoxies, adhesives, etc. Radioactive waste is generated from research activities using radioactive isotopes and the accelerator. Waste materials, both liquid and solid, are collected in containers at the satellite accumulation areas (LLNL 2002bh, LLNL 2002cq).

Building 194 operations generate small amounts of gaseous effluents. These gaseous effluents include radioactive isotopes of oxygen and nitrogen with half-lives of 2 and 10 minutes, respectively, and dust particles. The air emissions are filtered through HEPA filters and discharged to the atmosphere from a 30-meter monitored stack (LLNL 2002cq).

A.2.2.14 *Building 197 Complex*

The Building 197 Complex is located in the northwest quadrant of the Livermore Site and includes Buildings 197, 198, and T1879. These buildings contain semiconductor research laboratories, bench-top electronic assembly areas, plating and etching stations, research laboratories for the development of micro-electronic fabrication processes, and miscellaneous special studies laboratories. The buildings and their operations are summarized in Table A.2.2.14–1 (LLNL 1997f).

TABLE A.2.2.14–1.—*Summary of Building 197 Complex Operations*

Facility	Uses	Square Feet
Building 197	Laser pantography lab, high density plasma lab, gas immersion laser doping (GILD) lab, semiconductor/wafer scale integrated circuits (WSI) hybrid labs, hydrogen peroxide loading of microset crystal growth furnace	10,500
Building 198	Machine and welding shops,	966
Building T1879	Electronics fabrication and testing	11,118

Source: Original.

Hazards Assessment

The primary hazards associated with the Building 197 Complex include corrosive, toxic, flammable, and carcinogenic materials; cryogens; ionizing and non-ionizing radiation; lasers; high-voltage electricity; high temperatures; toxic gases; and compressed gases.

Controls for these hazards are specified in both facility and operational safety plans and integration worksheets. The use of a hood is required if the operation could potentially release material into the workplace. Personnel safety is ensured by toxic materials storage and handling systems. Toxic gases are used in closed systems and handled only in gas cabinets; adequate ventilation and safety valves are provided for added protection.

Generated Wastes and Effluents

Hazardous waste and nonhazardous waste are produced in these facilities and would include acid solutions; both lab-packed and bulk-waste chemicals; lab-packed spent halogenated and nonhalogenated solvent solutions, both organic and inorganic; empty containers; laboratory debris such as contaminated paper and rags, protective clothing, glassware, plasticware, tubing and fittings, wood and metal parts, and HEPA filters contaminated with hazardous constituents; electronic manufacturing wastes; etching wastes; waste oil with trace gasoline, diesel, organics, and metals; and contaminated equipment such as vacuum pumps, ignition tubes, and other equipment.

Some operations in Building 197 release small quantities of gases and organic vapors to the atmosphere. The gases from closed systems and fume hoods feed into a 52-foot-high exhaust stack. Because the quantities of gases used are small, the release of gases under the worst-case condition would not exceed the ERPGs (LLNL 1997f).

Liquid wastes from etching and plating operations are recycled at Building 197, and no wastes are discharged or removed from the facility (LLNL 2002ba).

A.2.2.15 *Building 231 Complex*

The Building 231 Complex is located in the southwest quadrant of the Livermore Site. The primary functions of the facilities in this complex are fabrication and testing of parts and assemblies to meet the needs of LLNL programs; storage of hazardous and radioactive material; and inspection, shipping, and storage of controlled materials. The Building 231 Complex includes the buildings listed in Table A.2.2.15–1.

TABLE A.2.2.15–1.—*Summary of Building 231 Complex Areas*

Facility	Name	Square Feet
Building 230	231 Portal	377
Building 231	Development and Assembly	131,454
Building 231V	Building 231 Vault	5,426
Building 232FA	Fenced Area	1,200
Building 233	Materials Management	4,900
Building 234	Materials Management Office	5,261

Source: Original.

Building 230 was constructed for use as a security check portal, but is currently used for storage of plastic sheet stock.

Building 231 consists of a high bay, laboratories, a machine shop, and offices. The high bay runs north/south for the entire length of the building and contains overhead cranes, large ovens, a large hydraulic press, and a rolling mill. A diverse range of R&D activities are conducted in the building, as follows (LLNL 2001b):

- **Machine Shop**—General machining operations include computer numerically controlled machining and turning capabilities. These operations provide primary manufacturing support for activities in Building 231.
- **Plastics and Advanced Composites Group**—Operations include adhesive and solvent bonding, casting, composite fabrication, plastic welding, heat sealing, and form molding. The operations also include a small machine shop for cutting and milling plastics and composites.
- **Vacuum Process Group**—Operations include performing physical vapor deposition and working with vacuum technology. Capabilities include working with high-purity metals, oxides, and ceramics and material characterization using mass spectrometry and residual gas analysis.
- **Mechanics of Materials Group**—Operations include characterizing the mechanical response of materials, components, and assemblies under various conditions of load, deformation, temperature, and environment. Services and capabilities include general test

capabilities as well as high-rate and intermediate-rate testing using mechanical and servo-hydraulic test machines; compression, tension, shear, torsion, and bend tests to determine modulus; fracture and fatigue testing; and special tests and capabilities for hardness, surface energy measurements of liquids and solids, and density measurements.

- **Physical Metallurgy and Joining Program Element Capabilities**—Operations include performing fabrication and research that includes metal forming and thermomechanical processing, electron-beam welding, vacuum brazing, tungsten inert gas (TIG), gas metal (MIG) and tube welding, solid-state bonding, and laser welding. Other activities performed include physical vapor deposition by sputtering and evaporation and the fabrication of entire coating systems.

- **Metallography and Scanning Electron Microscopy**—The metallography laboratory characterizes specimens that originate in the Building 231 processing and welding areas. A large range of specimen preparation equipment and characterization tools is present, including optical and scanning electron microscopes and hardness testing equipment.

- **Uranium Casting**—A vacuum induction furnace is used to melt uranium alloy castings in excess of 100 kilograms. Prepared castings are then processed using the capabilities in the thermomechanical area.

- **Heat Treatment**—Several high-vacuum furnaces are operated to heat treat refractory metals.

- **Liquid Metal Embrittlement Studies**—Metallurgical activities include studies of liquid metal embrittlement of structural alloys by elements having low melting points. These elements include thallium, mercury, and bismuth. The studies involve mechanical testing while immersed in the liquid metal and post-test characterization by scanning electron or optical microscopy.

The Building 231 vault is located adjacent to the building and currently functions as an inspection, shipping, and storage facility for controlled materials, which may be hazardous and/or radioactive. The shipping and receiving operations involve only small quantities of radioactive material (LLNL 2000o).

The fenced area is an addition to the north end of Building 232, an inactive laboratory facility. An open passageway separates the fenced area from Building 232. The Building 232 fenced area consists of a steel portal frame structure on a paved asphalt floor, covered with a roof of corrugated transite sheeting, and surrounded by a chain-link fence. A locked sliding gate, located on the west side, controls access. The Building 232 fenced area is used for storage of controlled and nuclear material. Materials are received by materials management personnel and may be inspected to verify contents, proper packaging, and labeling and to verify that proper shipping regulations have been followed. Other operations that may be performed include the repackaging and preparation of "controlled materials" and classified parts for transportation. Operations such as marking, labeling, regrouping of containers, and opening of outer containers is permitted within the facility (LLNL 2000p, LLNL 2001aa).

Building 233 consists of office space and a vault. The Building 233 vault is used for long-term storage of classified and controlled materials, including precious metals, accountable and controlled material, classified parts held for destruction, and components containing mock explosives. The Building 233 vault has a concrete slab floor and reinforced masonry walls (LLNL 2000p).

Building 234 is a single-story facility consisting of 24 offices, 2 restroom facilities, and a janitor's closet. It is used exclusively for administrative and management activities associated with the mission of the Materials Management Section (LLNL 2000p).

Hazards Assessment

Buildings 230 and 234 are considered general industry facilities. No hazardous or radioactive materials are stored, managed, or used within these facilities.

Building 231 is classified as a low-hazard chemical and radiological facility. The potential hazards in this facility are exposure to radiation and radioactive materials; exposure to carcinogenic, corrosive, reactive, and toxic materials; exposure to vapors and high-intensity light from open flame welding; handling and exposure to high explosives, hydrogen gas and other flammable or combustible liquids and gases; handling and operating high-pressure systems, lasers, sealed radioactive sources, and high-voltage equipment; operating and exposure to rotating equipment, other machine tools, cranes; and heavy plates, cylinders, and other objects being lifted; exposure to excessive noise; and exposure to glovebox leakage, implosions, and explosions. Hazardous materials that may be handled in limited quantities include natural and depleted uranium in solid form, natural thorium, rhenium, beryllium, lead, nickel, fibrous carbon materials, toxic resins and epoxies, methylene chloride, chloroform, ethylene dichloride, acetone, other solvents, tungsten hexafluoride, and acids used in chemical etching (LLNL 2001b).

The Building 231 vault is classified as a low-chemical hazard, radiological facility. An inventory report is generated daily to track radionuclides, primarily various sealed sources and depleted uranium, stored in the facility to ensure quantities of radioactive materials stay below the thresholds for a Category 3 Nuclear Facility (DOE 1997d). Hazards associated with the Building 231 vault include the stored legacy material of radionuclides and chemicals. Lithium hydride is also stored in the Building 231 vault. The original packaging is generally leak-tight with a primary container filled with argon atmosphere and a secondary container filled with dry air. Only a small percentage (<1 percent) of the lithium hydride inventory is expected to be in dispersible powder form. Powdered lithium hydride is of concern because of potential fire and explosion hazards when it reacts with moisture. Small quantities of flammable liquids and flammable gases used for cleaning and painting are permitted, but are stored within the flammable materials storage locker (LLNL 2000o, NNSA 2002d).

To ensure their safe conduct, activities in Building 231 and the Building 231 vault are governed by facility safety plans. Any hazardous activity not specifically discussed in facility safety plans requires an individual operating safety plan reviewed by the facility management and others and posted in the work area. These documents detail the processes that must be followed, any needed precautions, the responsible and approved personnel, training requirements, and contingency plans. Various safeguards, including air monitoring and HEPA filtration systems and hydrogen buildup and fire alarms, are provided throughout the building where needed. The work areas within the vault are kept at negative pressure, relative to the outside environment. Outside air is first filtered then passed through the clean area and into the work areas. The exhaust from the rooms and gloveboxes is filtered by two HEPA filters at all times. A backup power system ensures that the negative pressure in the vault can be maintained even in an emergency. If the exhaust system is not working, all work involving radioactive and hazardous materials stops (LLNL 2000o, LLNL 2001b).

The Building 232 fenced area and the Building 233 vault are classified as low-hazard and radiological facilities. Controlled and nuclear materials stored in the facilities include depleted uranium, low enriched uranium, natural uranium, lithium salts, deuterium, thorium, californium, and beryllium. Materials stored in the Building 233 vault are stored in containers and safes. Precious metals and small quantities of depleted uranium may be opened in the Building 233 vault. The storage and management of hazardous and radioactive material are controlled under the facility safety plan. Additionally, the quantities of radioactive and hazardous materials in the facility are controlled and monitored by computer-based inventory tracking systems (LLNL 2000p).

Generated Wastes and Effluents

The hazardous and nonhazardous wastes produced in Building 231 include alkaline and acid solutions, including lab-packed solutions; lab-packed waste chemicals; nonhalogenated solutions, both organic and inorganic; halogenated organics; empty containers; laboratory debris such as contaminated paper and rags, protective clothing, glassware, plasticware, tubing and fittings, wood and metal parts, and HEPA filters contaminated with hazardous constituents; machine shop wastes; flammable liquids; cleaning solutions, including solvents; waste oil with trace gasoline, diesel, organics, and metals; asbestos; wastewater and residues; discarded batteries; discarded capacitors that are potentially TSCA wastes; and contaminated equipment such as vacuum pumps, ignition tubes, and other equipment. Hazardous, low-level radioactive, and mixed wastes are accumulated at satellite accumulation areas within Building 231. When ready for disposal, the waste generator identifies, labels, and packages waste and then transfers containers directly to RHWM for proper disposal. The RHWM building technician assists the generator in labeling, packaging, and transfer operations. When necessary, the technician also conducts waste sampling and field analysis.

Hoods, gloveboxes, and enclosures used to control radioactive or hazardous particulates are ventilated to the outside environment through HEPA filters in Building 231. Various other exhaust systems are used to intermittently ventilate the paint spray booth, welding hoods, bead blasters, vacuum pump exhausts, laser cavities, and inert gas flush systems directly to the outside of the building.

Wastewater generated by laboratories in Building 231 is discharged into local lift stations. The lift stations pump the wastewater to pipes that gravity drain into two aboveground retention tanks located in a bermed concrete area at the northeast corner of Building 231. Wastewater in these tanks is sampled and, if within acceptable discharge levels, the wastewater is released to the sanitary sewer. If unacceptable for release, it is transferred to RHWM. No hazardous or radioactive material is discharged into the sanitary sewer or storm drain systems.

Radioactive and hazardous wastes in the Building 231 vault are also collected in satellite accumulation areas located in the rooms in which waste is generated and under the control of the generator. Radioactive waste such as contaminated smear tabs, gloves, or other nonhazardous materials, which have been exposed to and contaminated with radioactive material, are disposed of in an appropriately labeled radioactive waste container.

The Building 231 vault, Building 232 fenced area, and Building 234 offices contain no specific processes or activities that would typically generate a waste or effluent. However, personal protective equipment, wipes, empty containers, bags, etc., may be disposed of as hazardous and/or radioactive contaminated waste. Additionally, classified materials sent for destruction and future efforts to reduce inventory could result in materials, once stored for future use, to be determined waste and disposed of through RHWM.

A.2.2.16 *Building 235*

Building 235 is an 88,475-gross-square-foot facility. Building 235 is located in the southwest quadrant of the Livermore Site. The Building 235 Complex consists of research laboratories and offices and provides facilities for experimental research in chemistry and materials science and for performing materials analysis. The building houses a 4-million-electron-volt accelerator and an ion implanter. Typical activities include material fabrication and characterization, x-ray spectroscopy, metallography, actinide and biological materials research, biomedical research, biodegradation, fuel cell development and testing, a nanoscale synthesis and characterization lab, specialized target fabrication, and other specialized research projects (LLNL 2002ap, LLNL 2001ag, LLNL 2001ah).

Hazards Assessment

The primary hazards associated with Building 235 include corrosive, toxic, reactive, flammable, pyrophoric, and carcinogenic materials, beryllium, pathogens, allergens, irritants, explosives, cryogens, ionizing and non-ionizing radiation, lasers, high-voltage electricity, high temperatures, and compressed gases. Biological research may be conducted in the facility, with operations potentially up to and including RG-2. RG-1 agents are not associated with disease in healthy human adults and RG-2 agents are associated with human diseases, which are rarely serious and for which preventative or therapeutic interventions are often available. Wastes that contain RG-1 or RG-2 biological materials are managed as biohazardous wastes as a best management practice. Controls for these hazards are specified in facility and operational safety plans (LLNL 2002ap, LLNL 2001ag, LLNL 2001ah).

Generated Wastes and Effluents

The hazardous and nonhazardous wastes that are produced in Building 235 include alkaline and acid solutions, including lab-packed solutions; lab-packed waste chemicals; nonhalogenated solutions, both organic and inorganic; empty containers; laboratory debris such as contaminated paper and rags, protective clothing, glassware, plasticware, tubing and fittings, wood and metal parts, and HEPA filters contaminated with hazardous and radioactive constituents; cleaning solutions, including solvents; waste oil with trace gasoline, diesel, organics, and metals; discarded batteries; and contaminated equipment such as vacuum pumps, ignition tubes, and other equipment. Small amounts of both radioactive and mixed waste; e.g., laboratory chemical solutions and scintillation vials, are also generated. Waste materials are collected at satellite accumulation areas and then moved to a designated waste accumulation area.

The types of waste produced by the biological research include nonhazardous biological waste, biohazardous and contaminated sharps (medical) waste, and chemical waste. Biohazardous waste includes waste generated from research with RG-1 and RG-2 agents.

Building 235 also has a laboratory wastewater retention system that is used to collect and retain diluted nonhazardous and nonradioactive rinsewaters from laboratories until analysis determines they can be discharged to the sanitary sewer. Most laboratories are equipped with exhaust hoods that vent through HEPA filters to the atmosphere (LLNL 2002ap, LLNL 2001ah).

A.2.2.17 *Building 239*

Building 239, Radiography Facility, is a 12,517-gross-square-foot facility that contains nondestructive evaluation facilities (LLNL 2002bq). Facility operations involving radiography are carried out in the basement of the building. The basement consists of two large high bays that house linatrons, x-ray equipment machines and sealed sources (LLNL 2002dc). Facility operations consist of material property evaluations and determination of composition, density, uniformity, and cell or particle size and of assembly structural integrity (LLNL 2002ac).

Hazards Assessment

The range of hazards present in Building 239 include compressed gases, high-voltage electricity, reactive materials, explosives, hazardous and carcinogenic chemicals such as cleaning solvents, and ionizing and non-ionizing radiation.

Fissile materials in solid, nondispersible form at any workstation are limited to 25 kilograms of highly enriched uranium and 6 kilograms of fuel-grade equivalent plutonium. These materials are not dispersed or changed in form in the facility, and they are not stored in the building. Plutonium is not allowed to be in the same area as explosives (LLNL 2002dc). Sealed sources are also used in the facility. Transitory transuranic waste drums may be brought into the facility for radiography. The total resident quantity of material is maintained below Hazard Category 3 levels.

Chemical inventories typically consist of laboratory chemicals, cleaners, oils, etc. Lithium hydride and beryllium oxide are handled on a transitory basis, but are always in an approved container and are never handled uncontained in the building (LLNL 2002ac).

Generated Wastes and Effluents

Only solid radioactive waste is generated in Building 239. Solid radioactive waste may result from handling items potentially contaminated with radioactive material, including smear tabs, gloves, and other nonhazardous materials that may have been exposed to a radioactively contaminated item. A small amount of lead waste is generated primarily from expended lead screens used in film radiography cassettes. Other hazardous waste consists primarily of rags and paper towels used to apply cleaning solvent to various pieces of hardware.

No liquid radioactive waste is generated in the building. Liquid hazardous waste is generated during normal operation of the film-processing equipment. Liquid waste is accumulated and removed by RHWM (LLNL 2002ac).

A.2.2.18 *Building 241 Complex*

The Building 241 Complex is located in the southwest quadrant of the Livermore Site. It consists of a two-story building and several trailers. The complex includes laboratories, offices, and machining and storage facilities. Also included is a large high-low bay area. The ground floorspace is approximately 53,935 gross square feet and the mezzanine floor is about 7,910 gross square feet (LLNL 2002ap, LLNL 2001f).

Building 241 provides facilities for laboratory operations in materials development, measurement, and testing. Operations conducted in Building 241 include research in ceramics, surface science, electrochemical processes, high-pressure processes, biomedical sensors, recombinant DNA, chemistry, corrosion, processing of hazardous waste surrogates, nanoscale synthesis and characterization, and handling toxic and atmospherically sensitive materials. Building 241 also has offices, laboratories, a high bay area, storage space, a machine shop, and an electronics shop (LLNL 2002ap, LLNL 2001f, LLNL 2001ah).

Hazards Assessment

The primary hazards associated with Building 241 include corrosive, toxic, reactive, flammable, and carcinogenic materials, pathogens, allergens, irritants, cryogens, lasers, ionizing and non-ionizing radiation, high- and very-high-voltage electrical equipment, multiple heat sources, and compressed gases. Biohazards include infectious agents; tissues, including blood; and other items that may contain biohazardous agents. Controls for these hazards are specified in both facility and operational safety plans (LLNL 2002ap, LLNL 2001f, LLNL 2001ah).

Generated Wastes and Effluents

The hazardous wastes and nonhazardous wastes that are produced in the facility include alkaline and acid solutions, including lab-packed solutions; lab-packed waste chemicals; nonhalogenated solutions, both organic and inorganic; empty containers; laboratory debris such as contaminated paper and rags, protective clothing, glassware, plasticware, tubing and fittings, wood and metal parts, and HEPA filters contaminated with hazardous and radioactive constituents; cleaning solutions, including solvents; waste oil with trace gasoline, diesel, organics, and metals; discarded batteries; and contaminated equipment such as vacuum pumps, ignition tubes, and other equipment. Small amounts of both radioactive and mixed waste; e.g., laboratory chemical solutions and scintillation vials, are also generated. Waste materials are collected at satellite accumulation areas and then moved to a designated waste accumulation area.

The types of waste produced by biological research include nonhazardous biological waste, biohazardous and contaminated sharps (medical) waste, and chemical waste. Biohazardous waste includes waste generated from research with RG-1 and RG-2 agents. Wastes that contain RG-1 or RG-2 biological materials are managed as biohazardous wastes as a best management practice.

The building also has a laboratory wastewater retention system, which is used to collect and retain dilute nonhazardous and nonradioactive rinsewaters from laboratories until analysis determines it can be discharged to the sanitary sewer. Many laboratories are equipped with exhaust hoods, some of which vent through HEPA filters into the atmosphere (LLNL 2002ap, LLNL 2001ah).

A.2.2.19 *Building 243*

Building 243, the Energy and Environment Research Facility, is located in the southwest quadrant of the Livermore Site. This 17,884-gross-square-foot facility houses high-pressure equipment and laboratories used for the testing and analysis of rocks and other materials. Other activities performed in this facility include x-ray microanalysis; bioremediation experiments; rock cutting, crushing, and polishing; laser-assisted, high-pressure spectroscopic measurements; and machine shop activities.

The research in Building 243 is conducted in support of basic energy sciences, the Yucca Mountain Project, other LLNL-directed R&D, and defense programs (LLNL 2000q).

Hazards Assessment

The principle hazards associated with Building 243 are pressure vessels, high-pressure fluid systems, electrical, toxic materials, flammable liquid, cryogens, hazardous gases, x-rays, radioactive materials, lasers, and routine industrial hazards associated with machine shop activities.

Small quantities of common-use laboratory and shop chemicals are used for specimen preparation and analysis and small-parts cleaning. Hazardous chemicals stored and used in the facility include carbon tetrachloride, red fuming nitric acid, hydrofluoric acid, vinylidene chloride, methyl butyl ether, and 2-propanol. Various carcinogens are also stored and used in facility operations. These include ethylene dichloride, lead, arsenic, cadmium, chromium, and nickel compounds.

Ionizing radiation hazards are present as a result of the use of analytical x-ray machines and sealed radioactive sources. Laser hazards in the facility result from the operation of Class 3b and Class 4 laser systems.

Bioremediation characterization of LLNL groundwater can also be performed in this facility. These activities involve the use of naturally occurring BioSafety RG-1 microorganisms. Standard BSL-1 work practices and controls are followed during these activities (LLNL 2000q).

Generated Wastes and Effluents

The operations in this building generate small amounts of solid and liquid hazardous and radioactive waste. Hazardous and mixed wastes generated in Building 243 workplaces are collected in satellite accumulation areas.

Many sinks and floor drains in Building 243 are connected to the LLNL sanitary sewer system and are not intended for the discharge of hazardous wastes. Additionally, the building does not have a retention tank system (LLNL 2000q).

A.2.2.20 *Building 251*

Building 251 is located in the western portion of the Livermore Site. The operations in this 31,809-gross-square-foot facility have varied over its lifetime, but include preparing radioactive tracers used in underground testing and conducting a heavy element research program. These operations involved using multicurie quantities of transuranic radioisotopes and SNM. Building 251 is now in storage mode, awaiting possible commencement of the decontamination and decommissioning (D&D) process. In this mode, the building inventory of radioactive material is stored primarily in underground storage vaults. However, some material remains in two Mosler safes and in containers stored in the hot cells (LLNL 2001aj). There has been a continuing effort to reduce inventories of radioactive material and to clean up all gloveboxes, other enclosures, and laboratory spaces since the facility moved to program standby in 1995. LLNL began a Building 251 risk reduction program (RRP) in 2001 that is designed to bring the facility down to radiological status by April 2005. When the RRP is completed, most radioactive material, waste, and contaminated hardware would be removed, leaving mostly embedded spills in the building. Nearly all room-filtered exhaust systems would remain to provide protection for the public and the environment when a decision is made to D&D or reuse the building. The RRP consists of three well-defined projects:

- The Inventory Reduction Project to reduce inventory of stored radioactive materials
- The Glovebox Removal Project to remove unneeded gloveboxes
- The Glovebox Ventilation System Removal Project to evaluate glovebox ventilation systems and deactivate and remove those systems not necessary for future activities

Hazards Assessment

Building 251 hazardous material inventories were reduced during 1996 and 1997. The chemicals remaining in the facility include small quantities of acetone, ethyl alcohol, ethylene dichloride, hydrochloric acid, methyl isobutyl ketone, and sodium hydroxide. Other chemicals include adhesives, cleaners, fluxes, greases, lubricants, and sealants. Approximately 18 tons of lead, primarily in the form of bricks, is stored in the building.

In addition to these inventories, hazards to personnel also consist of exposure to ionizing radiation; cryogens; compressed gases; electrical shocks; high noise; asphyxiation, due to confined space hazards; and standard industrial hazards associated with D&D activities.

Building 251 contains numerous small-mass, legacy, transactinide isotopes, which include fissionable materials subject to criticality control. The criticality safety program in Building 251 maintains the entire inventory of fissionable materials to less than a minimum critical mass in order to ensure that a criticality accident is not credible (LLNL 2001aj). Implementation of the RRP is expected to result in hazard reclassification to a radiological facility.

The Glovebox Removal Project would necessitate the use of a variety of additional chemicals in the facility in order to clean the gloveboxes and equipment contained in them for packaging and disposal.

Generated Wastes and Effluents

The hazardous wastes and nonhazardous wastes that are produced in the facility would include alkaline and acid solutions, including lab-packed solutions; lab-packed waste chemicals; nonhalogenated solutions, both organic and inorganic; empty containers; laboratory debris, including contaminated paper and rags, protective clothing, glassware, plasticware, tubing and fittings, wood and metal parts, and HEPA filters contaminated with hazardous and radioactive constituents; cleaning solutions, including solvents; waste oil with trace gasoline, diesel, organics, and metals; discarded batteries; and contaminated equipment such as vacuum pumps, ignition tubes, and other equipment. Small amounts of both radioactive and mixed waste, such as laboratory chemical solutions and scintillation vials, are also generated. Radioisotopes of uranium, americium, curium, and plutonium are the principal radiological contaminants. The Glovebox Removal Project would increase the transuranic waste and low-level waste generated by the facility. The additional chemicals include various solutions to wash the inside surfaces of the gloveboxes to remove contamination; e.g., radiac wash, cerium nitrate, electrolytic stripping, etc., strippable coatings, and fixative coatings. Generated liquid waste would be stabilized before shipment. In addition, if a glovebox cannot be decontaminated to low-level waste levels, it would be size-reduced to fit into transuranic waste drums. This activity would be done in enclosures in the facility that are designed to contain contamination.

Each workspace, excluding offices, within Building 251 may be used as a satellite accumulation area. Waste is characterized, packaged, and prepared for transfer in accordance with RHWM guidelines.

Radioactive waste is also generated through building cleanup, repackaging, removal of equipment, storage, maintenance, and surveillance activities. Low-level waste and transuranic waste may also be generated during hot-cell or glovebox operations related to these activities. Radioactive liquid waste can be solidified within the building in small quantities in a glovebox. Other potential low-level radioactive liquids are placed in polyethylene waste carboys and sent to RHWM for disposition.

Liquids from laboratory sinks, eye washes connected to facility plumbing, the decontamination shower, and the floor drains are connected and diverted to the area retention sump and then pumped to one of the two 1,000-gallon retention tanks. Liquid in the tanks is sampled and held until laboratory analysis of radiological constituents indicates that the contents can be discharged into the sanitary sewer system. If sample results indicate concentrations in excess of discharge limits, it is transferred by tank truck to RHWM.

Air effluents from facility areas and processes are released though the facility ventilation system. This system consists of the glovebox exhaust system, the fume hood exhaust system, the room exhaust system, and the facility heating, ventilation, and air conditioning (HVAC) system. All systems are processed through HEPA filtration units. Each exhaust point from areas with contaminated enclosures or dispersible radioactive material is equipped with an isokinetic stack-sampling system. Filter papers are removed and evaluated by Hazards Control to determine the type and quantity, if any, of radioactive effluent (LLNL 2001aj).

A.2.2.21 *Building 253*

Building 253 is located in the central portion of the Livermore Site. This 32,276-gross-square-foot facility is LLNL's primary analytical laboratory for hazards control samples. LLNL operations include aliquoting, precipitating, acid digesting, and distilling samples; preparing calibration standards; and analyzing gross alpha and beta. The analytical laboratory has the following capabilities (LLNL 2001ak):

- **Flame Atomic Absorption Spectrometer**—Used for environmental lead analysis; provides backup capability for inductively coupled plasma
- **Flame Atomic Absorption Spectrometer with Graphite Furnace**—Used to analyze mercury and low-concentration metals
- **Inductively Coupled Plasma/Mass Spectrometer**—Used for uranium bioassay analysis and scan of metals in low concentrations
- **Inductively Coupled Plasma/Optima Emissions Spectrometer**—Used to analyze metal, including industrial hygiene metals and pump metals
- **Gas Chromatograph**—Used to analyze organic solvent
- **Gas Chromatograph/Mass Spectrometer**—Used to identify and measure organic solvents
- **Ion Chromatograph**—Used to analyze anions
- **High-Pressure Liquid Chromatograph**—Used to analyze high molecular weight solvents, formaldehyde, toluene dilsocyanate, MDI, etc.

Building 253 also houses the Whole-Body Counting Facility, which provides services for the in vivo analysis of radioactivity in the whole body and specific organs and provides gamma and alpha spectroscopy services for the analysis of in vitro and special samples. The Whole-Body Counting Facility consists of the control room and the counting room. The control room houses the computer system, the wound-counting system, the uninterruptible power supply, and other associated electronic and safety equipment. The counting room houses the whole-body-organ-, and thyroid-counting systems. Most of the procedures for in vivo measurements require shielding to reduce the natural background radiation associated with building material, soil, air, and cosmic rays. The ceiling, walls, and floor of the counting room are shielded. Air entering the counting room passes through two HEPA filters in series to control airborne radioactivity (LLNL 2001ak).

Hazards Assessment

Hazards associated with Building 253 operations include toxic and corrosive chemicals, solvents, resins, and radiation associated with the small quantities of radionuclides contained in samples.

Operations are controlled by a facility safety plan. Quantities of hazardous materials in the work area are limited to the minimum needed for each operation. The use of a hood is required if the operation could potentially release material into the workplace.

Generated Wastes and Effluents

The waste stream generated at Building 253 contains both hazardous and nonhazardous wastes that include alkaline and acid solutions, including lab-packed solutions; lab-packed waste chemicals; nonhalogenated solutions, both organic and inorganic; empty containers; laboratory debris such as contaminated paper and rags, protective clothing, glassware, plasticware, tubing and fittings, wood and metal parts, and HEPA filters contaminated with hazardous and radioactive constituents; cleaning solutions, including solvents; waste oil with trace gasoline, diesel, organics, and metals; discarded batteries; and contaminated equipment such as vacuum pumps, ignition tubes, and other equipment. Small amounts of radioactive and mixed waste; e.g., laboratory chemical solutions, resins, and solvent wipe cleaning materials, are also generated (LLNL 2002as). This material is collected in satellite accumulation areas and then moved to the Building 253 waste accumulation area and segregated. From there, the waste is transferred to the appropriate treatment/disposal facility by RHWM.

A.2.2.22 *Building 254*

Building 254, the Bioassay Laboratory, is located in the central portion of the Livermore Site. This 2,465-gross-square-foot facility is a wet chemistry laboratory that prepares urine and fecal samples for bioassay. Sample preparation operations include sample aliquoting, precipitation, ion exchange separation, and electrodeposition. The prepared samples are transferred to Building 253 for bioassay analyses (LLNL 2003af).

Hazards Assessment

Hazards associated with Building 254 operations include the use of acids such as hydrochloric, nitric, and sulfuric; ammonium hydroxide; solvents; and ion exchange resins and potential exposure to the small quantities of radionuclides contained in bioassay samples. Operations are controlled by a facility safety plan. Quantities of hazardous materials in the work area are limited to the minimum needed for each operation. The use of a hood is required if the operation could potentially release material into the workplace (LLNL 2003af).

Generated Wastes and Effluents

The waste stream generated at Building 254 contains both hazardous and nonhazardous wastes that include alkaline and acid solutions, including lab-packed solutions; lab-packed waste chemicals; resins; empty containers; laboratory debris such as contaminated paper and rags, protective clothing, glassware, plasticware, tubing and fittings, wood and metal parts, and HEPA filters contaminated with hazardous and radioactive constituents: waste oil with trace gasoline, diesel, organics, and metals; cleaning solutions including solvents; and contaminated equipment such as vacuum pumps, ignition tubes, and other equipment. Small amounts of radioactive and mixed waste; e.g., laboratory chemical solutions, resins, and solvent wipe cleaning materials, are also generated. Multiple waste steams are segregated and collected in various satellite accumulation areas, then moved to a waste accumulation area at Building 253 where the wastes are segregated from other noncompatible waste streams.

A.2.2.23 *Building 255*

Building 255 Calibration Facility is located in the central portion of the Livermore Site. This 21,813-gross-square-foot facility is divided into two sections, each housing independent operations. The eastern portion of the building houses the calibration and standards laboratory while the western portion contains the laboratory for development of diagnostic techniques (LLNL 2003m).

Radiation dosimetry calibrations are conducted in the eastern portion of Building 255 using both sealed and unsealed sources and radiation-generating equipment. This part of the facility is equipped with shielded irradiation cells housing radiation sources, support laboratories, and offices. Radiation sources used for calibration generate beta, gamma, x-rays, neutrons, and tritium. Several sealed sources are stored in this portion of the building (LLNL 2003m).

The western portion of Building 255 comprises offices, laboratories, and respirator services. Analytical chemistry, aerosol science, air cleaning performance, personal protective equipment performance, instrument development, and the industrial hygiene instrument laboratory are evaluated/housed in this portion of the building (LLNL 2003m). Respirator testing and cleaning are also performed in this area.

Hazards Assessment

The hazards present at this facility are those associated with handling fissile material and intense x-ray and gamma-ray sources. The eastern portion of Building 255's x-ray operations could produce an exposure rate of approximately 65,000 rem per hour, approximately 3 feet from the x-ray head. Sealed sources of radiation in this portion of the building could produce high radiation exposure from cobalt-60, californium-252, and cesium-137. The maximum rates of exposure from these sources are 8 rem per hour at approximately 3 feet from a gamma source such as cesium-137 and cobalt-60 and 5 rem per hour at approximately 3 feet from a neutron source such as californium-252 (LLNL 2003m).

Storage and use of the radioactive standards, including tritium, and tracers do not exceed 120 microcuries each in the western portion of Building 255. The small amounts in use do not represent an external hazard from the x-ray and gamma radiation emitted from these materials. Similarly, the alpha and beta radiation from a majority of the isotopes does not represent a problem with internal deposition at these low levels. The estimated unshielded exposure rate from gamma radiation is not expected to exceed 1 millirem per hour at 0.4 inch while personnel are handling these materials (LLNL 2003m).

Maintenance and calibration gases, including carbon dioxide, carbon monoxide, hydrogen, methane, various refrigerants, and hydrogen sulfide, are used in the calibration of instruments in the eastern portion of Building 255. Carbon monoxide and hydrogen sulfide are toxic and overexposure to these gases may result in serious health effects. Therefore, mixtures at or below five times the Occupational Safety and Health Administration permissible limit or threshold limit value of the toxic gas are used. A mercury vapor source is also present for calibrating mercury meters. Exposure may result in serious health effects. The laboratory ventilation system helps reduce risk to exposure of these materials (LLNL 2003m).

The rooms and storage cells in the eastern portion of the building that contain radioactive sources are equipped with safety interlocks and warning lights to prevent entry during operations. A remote area monitoring system provides a readout at the control console and initiates both an audible and a visual alarm if radiation is present in the cell and the cell door is open. The cell used for the storage of radioactive sources is further equipped with a continuous air monitor (LLNL 2003m).

There are no special access controls associated with the western portion of the building. Only authorized personnel are permitted access to these laboratories, which remain locked when not in use (LLNL 2003m).

Generated Wastes and Effluents

The waste stream generated at Building 255 contains both hazardous and nonhazardous wastes that include alkaline and acid solutions, including lab-packed solutions; lab-packed waste chemicals; nonhalogenated solutions, both organic and inorganic; empty containers; laboratory debris such as contaminated paper and rags, protective clothing, glassware, plasticware, tubing and fittings, wood and metal parts, and HEPA filters contaminated with hazardous and radioactive constituents; cleaning solutions, including solvents; waste oil with trace gasoline, diesel, organics, and metals; discarded batteries; and contaminated equipment such as vacuum pumps, ignition tubes, and other equipment. Small amounts of radioactive and mixed waste such as laboratory chemical solutions and scintillation vials are also generated. This material is collected in satellite accumulation areas, then moved to a waste accumulation area at Building 253 and segregated. From there, the waste is transferred to the appropriate treatment/disposal facility by RHWM (LLNL 2003m).

A.2.2.24 *Building 261/262*

Building 261/262 is located in the northwest quadrant of the Livermore Site. This 53,197-gross square-foot facility houses NAI program personnel and the Safeguards and Security Department CAIN Maintenance Group. The eastern portion of Building 261 consists primarily of office space, but also houses computing equipment and a vault-type security area. The western portion contains laboratory and office space. Building 262, a large containment structure, is attached to the south side of Building 261 (LLNL 2002k).

The Building 262 dome is divided into two equal compartments. Currently, the west dome is used for NAI/B-division experiments and the east dome is used as a storage facility. Future plans include the use of both compartments for experimental activities. The experiments conducted in Building 262 are designed to investigate the feasibility of developing a safe, portable, nondestructive, neutron-based apparatus and technique for in situ identification and qualification of various elements in closed containers. The experiments employ various types of portable neutron generators, radiation detectors, test samples, and radiation-shielding materials (LLNL 2002k).

Hazards Assessment

The hazards associated with Building 261/262 include operation of the neutron generators and handling small quantities of hazardous materials involved in research activities. Hazardous materials used at this facility include solvents; pyrophoric materials; e.g., mock explosives; combustible and toxic metals; sealed radioactive sources; and other radioactive material in solid form (LLNL 2002k).

The handling and storage of hazardous materials is controlled under the applicable operational safety procedures. Quantities of hazardous materials in the work area are limited to the minimum needed. In addition, Building 262 is equipped to provide fully automated remote operation capability, including a portable control room located just outside the dome, which houses the controls and electronic equipment for neutron generator operation. Total remote controlled operation, access interlocks, and 5-foot-thick concrete shield walls mitigate the radiation exposure hazards (LLNL 2002k).

Generated Wastes and Effluents

The principal liquid waste stream within Building 261 contains photolab developer and fixer. Solvents, oils, and organic liquids are held to an absolute minimum. Liquid hazardous waste is typically less than 100 gallons per year. Solid hazardous waste is anticipated in relatively small quantities and is expected to be primarily composed of lab trash; e.g., contaminated wipes and rags from the printing press operation. Generation of radioactive waste is not planned. However, small quantities could be generated if solid metal uranium and thorium parts were found to have surface oxidation. Mixed waste may be generated if a hazardous material, such as a solvent, comes in contact with a radioactive material, such as solid uranium, and a residual waste is generated. Wastes generated from this facility include small quantities of hazardous wastes and low-level radioactive wastes contaminated primarily with depleted uranium, natural uranium, and thorium (LLNL 2002k). Hazardous and mixed wastes generated in Building 261 workplaces; e.g., laboratory, shop, etc., are collected in satellite accumulation areas.

A.2.2.25 *Building 272*

Building 272, the Electro-optic Development Laboratory, is a two-story, 9,978-gross-square-foot facility located in the northwest quadrant of the Livermore Site. The facility consists of office, laboratory, and shop space. The building's use is currently in transition, having been used previously for etching circuit boards and interferometer detection systems. The building's second floor is currently being used by the Information Science and Technology Program.

Hazards Assessment

The primary hazards associated with Building 272 are limited to solvents, lubricants, cleaners, compressed gases, and limited paint. Although cryogenics have been used periodically in the facility, no cryogenics are stored in the building (LLNL 2002at).

Generated Wastes and Effluents

Small quantities of hazardous wastes are generated.

A.2.2.26 *Building 281*

Building 281, the Health and Ecological Assessment Laboratory, is located in the northwest quadrant of the Livermore Site. This 18,549-gross-square-foot facility comprises laboratory, shop, office, and refrigerated storage space. A number of programs and research activities are underway in the Building 281 laboratories including, but not limited to, general wet chemistry, radiochemistry, analytical chemistry, surface science, and biological analysis. Operations in Building 281 include radioactivity migration studies, dissolution studies, flow studies, and tracer solution preparation.

Hazards Assessment

The primary hazards associated with Building 281 operations include low-level radioactive tracer solutions and sealed sources, ionizing radiation; concentrated acids and bases; toxic, flammable, and carcinogenic materials; RG-1 and RG-2 biological materials; lasers; cryogens; high-voltage electricity; and high temperatures and pressures. Controls for these hazards are specified in both facility and operational safety plans. The use of a hood is required if the operation could potentially release material into the workplace.

Generated Wastes and Effluents

The operations in Building 281 generate small amounts of solid and liquid hazardous, nonhazardous, and biological wastes. The hazardous and nonhazardous wastes produced in the facility include alkaline and acid solutions, including lab-packed solutions; lab-packed waste chemicals; nonhalogenated solutions, both organic and inorganic; empty containers; laboratory debris such as contaminated paper and rags, protective clothing, glassware, plasticware, tubing and fittings, wood and metal parts, and HEPA filters contaminated with hazardous and radioactive constituents; flammable liquids; cleaning solutions, including solvents; and contaminated equipment. Small quantities of radioactive and mixed waste may also be generated. Waste materials, both liquid and solid, are collected in containers at workplace accumulation areas in or near the laboratories where the waste is generated. The waste is segregated until collected by RHWM. Wastes that contain biological materials could be managed in several different ways, from nonhazardous to biohazardous, depending on their characteristics. As a best management practice, all nonhazardous and nonradioactive wastes containing biological materials are sterilized prior to disposal. Some operations in Building 281 release small quantities of organic vapors to the atmosphere. These vapors will not exceed their respective ERPG values even under the worst-case conditions.

A.2.2.27 *Building 298*

Building 298, the Fusion Target Fabrication Facility, is located in the northwest quadrant of the Livermore Site. This 47,780-gross-square-foot facility consists of various laboratories, a machine shop, and office areas. The facility supports the ICF Program, the Laser Science and Technology

Program, and the NIF Program. Supporting activities involve developing and analyzing cryogenic deuterium-tritium fusion targets, producing fusion targets, and developing state-of-the-art optics associated with the NIF Program. Operations within the building include laser cutting; 2,000-pound-per-square-inch D2 pumping system; specialty gas equipment and gas mixing activities; sol-gel optical coating process R&D laboratory; capsules and organic materials development; cryogenic target studies; target development, fabrication, and characterization; excimer laser ablation of polystyrene; diffractive optics development labs; diffractive optics fabrication; cryogenic hohlraum development; and cryogenic target studies (LLNL 2002ai).

Hazards Assessment

Building 298 is classified as a radiological/general industry facility. The primary hazards within the building include fire, the operation of chemical and physical laboratories, exposure to laser beams and x-rays, the use of vacuum and gas pressure systems, and leakage of cryogenic fluids. The facility is equipped with an automatic sprinkler system; access to lasers is controlled by warning signs, lights, signals, intercom systems, and door interlocks; the vacuum and pressure systems use engineering and operational safeguards; and the cryogenic fluid systems have been designed in accordance with LLNL safety standards (LLNL 2002ai).

Other operational and safety controls include radiation protection monitors, alarms, and controls; HEPA-filtered air flow hoods for depleted uranium in the sputtering assembly area; and radiation shielding for the radiographic machines.

Over 5,300 chemicals have been identified as being stored and/or used in facility operations. Of these 5,300 chemicals, 7 exceeded the reportable quantity listed in 40 CFR §302.4. These included benzene, carbon tetrachloride, chloroform, lead, beryllium, n-butyl phthalate, and chlorine. Primary radionuclides of concern are tritium and depleted uranium (LLNL 2002ai).

Generated Wastes and Effluents

Wastes generated from this facility include hazardous wastes and low-level radioactive wastes contaminated primarily with depleted uranium, tritium, and thorium. Wastes are collected in designated containers in the satellite accumulation areas. A retention tank system is located north of Building 298. The system is designed and managed to routinely accept nonhazardous and nonradioactive wastewater that enters the system via specially designated sinks in the building (LLNL 2002ai).

A.2.2.28 *Building 321 Complex*

The Building 321 Complex, the Engineering Technology Complex, is located in the southwest quadrant of the Livermore Site. The primary function of these facilities is the fabrication of parts and assemblies to meet the needs of LLNL programs. This complex includes the buildings listed in Table A.2.2.28–1.

TABLE A.2.2.28–1.—*Building 321 Complex*

Facility	Name	Square Feet
Building 321	Materials Fabrication	149,489
Building 322	Plating Shop	5,822
Building 322A	Metal Finishing Facility Annex	340
Building 329	Laser Weld Shop	5,214
Building T3203	Materials Fabrication	632
Building T3204	Materials Fabrication	647

Source: Original.

Building 321 consists of several wings. Building 321A contains a large high-bay machine shop. There are numerous machine tools in this bay, and they vary in size from large computer numerical control mills and lathes to small conventional machines. Building 321A contains shops and offices, including the Optics Facility. The Heat Treat Facility and Spin/Press Forming Shop have large pieces of equipment used for their respective operations as well as furnaces heated by electric elements. Building 321A also includes an electronics circuit board fabrication process (LLNL 2001aw).

Building 321B contains electronics fabrication, powder coating, and silk screening operations. Building 321C contains offices, shops, and storage areas. The Numerical Control Shop is equipped with computer numerical control mills and lathes and has electrical discharge machining capabilities. The water jet cutting machine uses high-pressure water and garnet to cut a variety of nontoxic materials including metals, ceramics, and plastics. A vault is also included in Building 321C where classified hardware and accountable materials are stored (LLNL 2001al).

Building 321D holds the circuit board fabrication and wave-soldering machine. Building 321E is the main mechanical equipment room for the Building 321 Complex. Building 322 is a plating shop used to finish metal surfaces with a wide variety of protective and functional surface coatings. It contains a large number of tanks of chemical solutions and rinsewater for processing parts.

Building 322A is used for glass bead blasting and nonhazardous storage (LLNL 2001e). Building 329 houses laser processing, including cutting, drilling, etching, and welding, of various materials such as plastics, ceramics, and metals, including beryllium and depleted uranium. Trailer 3203 houses a limited machine shop and a chemical storage area. Trailer 3204 provides a conference room, office space, and a change room for the metal finishing buildings.

Hazards Assessment

Buildings 321A and 321C are classified as low-hazard, radiological facilities. Building 322 and Trailer 3203 are classified as low-hazard facilities. Buildings 321B, D, and E; 322A; and 329 and Trailer 3204 are classified as general industry. The primary hazards within the complex include chemicals, acids, rotating machinery, hazardous and radioactive material operations, high temperatures, cryogenic materials, pressure, lasers, high voltage, and x-rays (LLNL 2001aw).

In Building 321A, the Heat Treat Facility and Spin/Press Forming Shop are permitted to form and heat treat fissionable materials such as D-38 (depleted uranium) and low-level radioactive material such as natural and depleted uranium and thorium. The Heat Treat Facility may also process toxic materials, such as beryllium. These areas are controlled, monitored, and routinely surveyed for airborne contaminants.

In Buildings 321A and 321C, material fabrication includes machining and forming operations of various metals and hazardous and radioactive materials that may include compounds of uranium, thorium, cobalt, beryllium, and lithium hydride. Lithium hydride solid, uranium, and powdered beryllium have established maximum inventory limits. A HEPA filter replacement requirement and a periodic cleanout of the cyclone separator catch basins have been established (LLNL 2001al).

Operations in Building 322 use, store, and dispose of chemicals used in the electroplating industry, including cyanide, arsenic, nitric acid, hydrochloric acid, sodium hydroxide, ammonium sulfate, acetone, and perchloroethylene. Concentrated liquid plating waste solutions are collected and transferred to a holding tank (LLNL 2001e). Building 329 houses laser processing of materials including beryllium, fluorine, and depleted uranium.

The Building 321 Complex is equipped with contamination control areas for processing toxic and radioactive materials such as arsenic, beryllium, uranium, thorium, lithium hydride, and mercury compounds. Enclosures and close-capture systems, such as hoods and gloveboxes, are provided when working with radioactive and toxic material. The machine tools are provided with ventilation systems that aspirate the fine particulates and mists and capture them in HEPA filters.

In recent years, no uranium-235 parts or assemblies have been processed that could become critical; however, the complex is capable of handling such parts if required. Two rooms of the Materials Fabrication Shop are equipped with nuclear accident dosimeters and criticality alarms. Special criticality evaluations and safety procedures are required for such work.

Generated Wastes and Effluents

The hazardous and nonhazardous wastes that are produced in the facility includes alkaline and acid solutions, including lab-packed solutions; bulk and lab-packed waste chemicals; nonhalogenated solutions, organic and inorganic; empty containers; laboratory debris such as contaminated paper and rags, protective clothing, glassware, plasticware, tubing and fittings, wood and metal parts, and HEPA filters contaminated with hazardous constituents; wastewater; residues; cleaning solutions, including solvents; waste oil with trace gasoline, diesel, organics, and metals; discarded batteries; and contaminated equipment such as vacuum pumps, ignition tubes, and other equipment. Mixed wastes such as coolants, laboratory debris, contaminated equipment, and metals are and also generated.

A.2.2.29 *Building 327*

Building 327, the Nondestructive Evaluation Facility, has a floorspace of 19,052 gross square feet and is located in the south-central portion of the Livermore Site. The activities and operations include the receipt and handling of hazardous materials; maintenance and operation of radiation-generating devices (RGDs), such as x-ray machines and sealed sources; film-processing equipment; ultrasonic and acoustic test equipment; infrared imaging equipment; dye penetrant and magnetic particle equipment; eddy current equipment; visual inspection equipment; and various support equipment and systems (LLNL 2000d).

Hazards Assessment

Building 327 is classified as a radiological facility. The primary hazards within the building include common industrial hazards, hazardous and radioactive material operations, high temperatures, cryogenic materials, lasers, high voltage, and x-rays. Minor amounts of chemicals are kept in the building, including cleaning solvents and photographic chemicals. Lithium hydride is contained within components. Beryllium is handled in the facility, but only in solid parts that are nondestructively examined. Because of the amount and nature of the chemical and toxic materials, the facility may be considered a general industry facility (LLNL 2000d, LLNL 2000r).

Nondestructive evaluation is conducted on radioactive materials, solid (nondispersible) uranium or thorium materials, biological clinical specimens, and samples of encapsulated or unencapsulated explosives in specific rooms. Use and handling of biological clinical samples are potentially hazardous. Work with these materials can be conducted safely if proper procedures and facilities are used.

The total quantity of fissionable material present in Building 327, including sealed sources, may not exceed specified limits and criteria (LLNL 2000r). Materials that require the facility to be rated as a radiological facility may be reduced in the future to levels that would result in reclassification to a general industry facility.

Generated Wastes and Effluents

The operations in Building 327 generate solid and liquid wastes; e.g., acid solutions and solvent-contaminated debris, and solid low-level radioactive waste. The potential for generating mixed waste is small and is minimized by the proper segregation of hazardous and radioactive waste. Hazardous and mixed waste generated in the workplace are collected in satellite accumulation areas. Spent fixer and developer from film processing are disposed of pursuant to ES&H Manual requirements. Low-level radioactive waste is also collected in satellite accumulation areas.

The facility water retention tank system is located on the west side of the building and consists of a 5,000-gallon fiberglass in-ground tank designed and managed to accept nonhazardous waste from the ultrasonic tank. Retention tank wastewater is released to the sanitary sewer after characterization and when within release limits. Sinks and floor drains are connected to the sanitary sewer system and are intended for the discharge of nonhazardous waste only (LLNL 2000r).

A.2.2.30 *Building 328 Complex*

Buildings 328, 328A, and 328B, the Hazards Control Fire Test Facility, are located in the south-central portion of the Livermore Site. Building 328 is a 372-gross-square-foot steel building where LLNL conducts burn tests, located in the south-central portion of the Livermore Site. Burn tests can be for LLNL projects or work for others. Diagnostic instrumentation and signals are fed to Building 328B, a smaller corrugated aluminum building of 288 gross square feet that contains diagnostic instrumentation and HEPA filters for cleansing the exhaust fumes prior to release. Building 328A is also corrugated aluminum and is used as a storage area. This 720-gross-square-foot building was scheduled to be demolished in 2002, but is still standing.

Hazards Assessment

Hazards associated with this facility include high temperature, off-gases, smoke, and open flames. No hazardous materials are currently used or stored in any of the complex buildings.

Generated Wastes and Effluents

Generated solid wastes may consist of unburned project material or the ash remains of burned material. Solid wastes will also include HEPA filters containing some particulates. Generated solid waste is containerized as appropriate for treatment or disposal by RHWM. Effluents to the atmosphere may include carbon monoxide, nitrogen oxides, hydrocarbons, and particulates.

A.2.2.31 *Building 331*

Building 331, the Tritium Facility, is part of the Superblock, a protected area located in the southwest quadrant of the Livermore Site. The 28,493-gross-square-foot building contains laboratories, offices, and a machine shop. The access-controlled area of Building 331 consists of two connected wings. The first wing was constructed in 1958 and houses primarily the actinide chemistry laboratories. The second wing was constructed in 1964 and houses primarily the tritium area. However, actinide and tritium work can occur in either wing.

Current activities in the facility include both tritium and nontritium operations. Tritium operations include tritium-related research, tritium recycling, decontamination and renovation activities, legacy waste processing, and tritium systems design; e.g., the Tritium Facility Modernization Project, and operational support. Nontritium processes include assaying plutonium; handling small amounts of explosives, such as squib valves, and other transuranic isotope specimens in small quantities; computed tomography; elemental characterization; and carbon dioxide cleaning (LLNL 2002w).

The tritium area laboratories are used primarily for experimental work with the isotopes of hydrogen gas, metal hydrides in contained beds, and small amounts of experimental metal hydrides and tritium-labeled compounds.

Tritium operations similar to those currently being performed would continue and expand. Programmatic work would include support of high-energy density target development especially for cryogenic targets and test readiness. Efforts for the recovery and recycling of tritium would also expand. Several projects supporting Defense Programs mission objectives and involving tritium and SNM may be performed as well. Facility initiatives to support expanded tritium operations include increasing the material at risk to 30 grams of tritium and conducting the Tritium Facility Modernization Project, which would renovate and modify approximately 4,000 square feet of laboratory space for installation and operation of a modern hydrogen isotope research capability (LLNL 2002w).

Nontritium operations include (LLNL 2002w):

- Carbon dioxide cleaning system for decontaminating parts
- Computed tomography for determining the internal structure of mock weapons materials
- High-sensitivity neutron instrument for surveying waste containers generated in the Plutonium Facility (Building 332)
- Surface characterization laboratory for analyzing the elemental and chemical composition of the surface of solid actinide samples using a variety of techniques such as x-ray photoelectron spectrometer (XPS), scanning auger microprobe (SAM), scanning electron microscope, x-ray diffractometer, and x-ray fluorescence
- Elemental and isotopic analysis laboratory for analyzing the elemental and isotopic composition of liquid and solid actinide samples using spectrometers, such as an Inductively Coupled Plasma/Mass Spectrometer and an Inductively Coupled Plasma/Optima Emissions Spectrometer
- Glow discharge mass spectroscopy laboratory for analyzing the elemental and isotopic composition of solid actinide samples by sputtering the surface and measuring the ionized species with an instrument such as a mass spectrometer

Nontritium operations similar to those currently being performed would also continue and expand. Use of the carbon dioxide cleaning system would increase, and new actinide chemistry operations would be added to allow for disposition. Programmatic work would include characterization of HEPA filters from the NMTP facilities and repackaging and storing low-level waste and transuranic waste containers. Preparing SNM targets for the NIF experiments and post-shot recovery and disposition operations would also take place in Building 331 (see Appendix M).

Hazards Assessment

The primary radiological hazard in Building 331 is associated with the handling and storage of tritium, SNM, and other radioactive isotopes. Other hazards include high-pressure gases, x-ray, lasers, hazardous and toxic materials; e.g., beryllium, mercury, and asbestos from D&D activities, high magnetic fields, cryogenic liquids, and small quantities of high explosives such as squib valves.

The bulk of the tritium inventory is in elemental form or metal hydrides capable of being turned into elemental form by heating. A small amount of tritium is used in the labeling of compounds or in the synthesis of lithium hydride. Some tritiated water is formed in the facility's tritium cleanup systems.

Building 331 is divided physically and operationally into zones of relative potential hazard. All experimental laboratories and work with radioactive materials is limited to the radioactive materials area (RMA). The RMA is separated by double doors from the offices and shop area.

Building 331 has an engineered ventilation system to protect workers and to control the release of radioactive material to the environment. Within the RMA, pressure gradients are maintained so that air always flows from clean areas toward areas of increasing contamination potential; i.e., from the RMA hall, to the lab, to the hood. The system is designed to quickly dilute and exhaust tritium through two 100-foot-high continuously monitored stacks.

In the actinide chemistry laboratories, material is handled in forms or enclosures to prevent its release to the worker's breathing zone and control exposure to airborne radioactive material within the facility. All exhaust from active gloveboxes in the actinide laboratory areas is filtered through multiple stages of HEPA filters; this exhaust is continuously sampled and monitored for radioactive contamination prior to release from the facility. Any contamination within a glovebox is confined to its ventilation zone.

In addition to the engineered controls supplied to keep radioactive materials out of the worker's breathing zone, workers are further protected by using continuous air monitors that continually monitor the breathing zone air for tritium and other radioactive materials and sound an alarm to warn the workers if the activity exceeds a preset level. Gaseous effluents from the facility are also monitored in this fashion. To provide a lower limit of detection than is possible with the continuous air monitors, passive air sampling, which does not have alarming capability, is also conducted in work areas before gases are exhausted from the facility.

The air monitoring equipment is electrically connected to the uninterruptible power supply and emergency power system. If power is lost, the uninterruptible power supply will provide power for the time it takes the standby diesel generator, shared with Building 334, to start and assume the load (LLNL 2002cu).

Generated Wastes and Effluents

The hazardous and nonhazardous wastes that are produced in the facility include alkaline and acid solutions, including lab-packed solutions; lab-packed waste chemicals; nonhalogenated solutions, organic; empty containers; debris such as contaminated paper and rags, protective clothing, glassware, plasticware, tubing and fittings, wood and metal parts, and HEPA filters contaminated with hazardous constituents; cleaning solutions, including solvents; and waste oil with trace gasoline, diesel, organics, and metals. Radioactive and mixed wastes; e.g. laboratory debris, contaminated equipment, and metals, contaminated with tritium and other radioactive material are also generated. D&D activities may result in laboratory equipment and gloveboxes potentially contaminated with low-level waste components.

Air containing tritium is exhausted from the rooms, gloveboxes, and hoods within the RMA and is discharged through two 100-foot-high continuously monitored stacks. Air discharged from the actinide chemistry laboratories may contain small quantities of organic vapor. These discharges are within permitted limits for the glovebox exhaust systems (LLNL 2002cu).

A.2.2.32 *Building 332 Plutonium Facility*

The Building 332 Plutonium Facility is part of the Superblock, a protected area located in the southwest quadrant of the Livermore Site. This building has a total area of 104,687 gross square feet, including radioactive materials laboratories, mechanical shops, change rooms, storage vaults, a fan loft, basement, equipment rooms, and offices. There are currently 24 laboratories in which radioactive materials can be handled within the RMAs of the facility (LLNL 2002br, LLNL 2002r).

The mission of Building 332 includes R&D in the physical, chemical, and metallurgical properties of plutonium and uranium isotopes, compounds and alloys, and certain actinide elements. This basic mission and these research capabilities support DOE's Defense Programs and the Stockpile Stewardship and Management Plan. The major activities in Building 332 include testing plutonium-bearing and uranium-bearing engineering assemblies; fundamental and applied research in the metallurgy and chemistry of actinide elements, compounds, and alloys; development and demonstration of pyrochemical processing methods; development of plutonium coatings and fabrication; enhanced surveillance and pit surveillance; pit assembly and disassembly; and pit reuse. These main activities are supported by metallography, chemical, and radiographic, including x-ray, analyses.

Operations within Building 332 include melting, casting, welding, and machining; developing alloys and heat treating: testing torsion, tensile, and compression; measuring density and heat capacity; machining, inspecting, and testing components; using chemical processes to purify, separate, or convert actinide materials; pressure testing and gas filling operations; and assembling components. Chemical analyses can also be conducted on gram-sized samples in support of these activities.

The Materials Management Division is responsible for all shipments of radioactive and other controlled materials to and from Building 332, as well as movement within the building. This division also controls storage of these materials in the building vaults. The vaults are equipped to safely store fissile, radioactive, and certain other SNM required for programmatic operations. Criticality safety controls for the vaults include specially designed storage racks and containers to control the spacing of stored fissile materials and mass limits for each storage location or rack cell within a storage vault. Criticality safety controls also specify mass limits for each workstation. The basic administrative workstation plutonium limit is 220 grams. A larger quantity can be authorized by management in an operational safety plan (LLNL 2002r).

Operations similar to those currently being performed in Building 332 would continue and expand. Programmatic work would include reactivating the engineering demonstration system hardware to perform a series of laser isotope separation demonstration experiments on surrogate and other materials for the Advanced Materials Program (DOE 2002o). Facility initiatives to support expanded Plutonium Facility operations include increasing the material limit for two rooms and the Building 332 ductwork replacement project, which replaces an old glovebox exhaust system (DOE 2003b). Other facility initiatives include rebuilding the downdraft system to eliminate contaminated ducting and wooden box HEPA filters in the loft; installing a drum repacking area; installing a modern analytical chemistry room; installing a radiography cave; replacing an autoclave; and various room cleanouts, equipment replacements, and D&D of older equipment.

Programmatic enhancements and facility initiatives in existing laboratories are ongoing activities in Building 332 and are part of its R&D mission in support of DOE's programmatic requirements. Some examples of near-term programmatic enhancements include weapon-type welding and nonnuclear development work, which includes installing a new laser welding system in an existing laboratory; developing and demonstrating engineering demonstration units for different weapon types; and demonstrating a modular system for the modern pit facility foundry, the Livermore Casting and Shaping Technology System, which includes installing a set of modular gloveboxes in an existing laboratory, all tied together with an enclosed transport system designed to minimize worker exposure and reduce potential environmental, health, and safety impacts. Major components of the system glovebox line include size reduction, feed casting and blending, breakout and storage boxes, shape casting, heat treatment, density measurements, and mold and crucible preparation. Another near-term programmatic enhancement project includes demonstration of a modular system for the low-exposure actinide processing, which includes mechanically disassembling pits using pit bisectors or lathes, retrofitting and automating the hydriding and chlorination systems, decontaminating highly enriched uranium using electrolytic or carbon dioxide pellet blasting, sanitizing and declassifying non-SNM parts, and using an evaporative purification system using a cold wall furnace.

Hazards Assessment

The primary potential hazard in this facility is exposure to airborne radioactive material. Plutonium and enriched uranium are the materials of primary concern. Plutonium and enriched uranium are fissile materials and quantities will be present that must be properly controlled to prevent assembly of a critical mass. Plutonium and enriched uranium are also reactive metals and alpha emitters. Fine powders, oxide, or metal involved in a fire have the potential for dispersal. Personnel handling dispersible forms are at risk for internal contamination and must be properly protected.

Other hazards in Building 332 include ionizing and non-ionizing radiation, x-ray, lasers, compressed gases, corrosives, asphyxiants, solvents, halogenated organics, hazardous and toxic materials; e.g., lead, beryllium, mercury, and asbestos from D&D activities, high temperature equipment, hydrogen, combustible and flammable materials, vacuum chambers, and cryogenic liquids.

The facility is divided physically and operationally into zones of relative potential hazard. Storage and work with radioactive materials is limited to the RMA. Handling material in forms or enclosures that prevent its release to the worker's breathing zone controls exposure to airborne radioactive material within the facility. Handling the material in the RMA, which has an engineered ventilation system, controls release of radioactive material to the environment. Within the RMA, pressure gradients are maintained so that air always flows from clean areas toward areas of increasing contamination potential. In addition, entry into the radioactive materials area is through air locks that maintain the pressure gradient. All exhaust from the gloveboxes and laboratory areas is filtered through multiple stages of HEPA filters; this exhaust is continuously sampled and monitored for radioactive contamination prior to release from the facility. Processing in gloveboxes is usually done under an inert gas atmosphere (nitrogen or argon), since finely divided plutonium may spontaneously ignite in moist air. Any contamination within a glovebox is confined to its ventilation zone. Only in the case of a spill would decontamination of a room or the building become necessary.

Two diesel generators provide emergency power for safety system structures and components. These generators can assume full load within minutes. Battery power is supplied to selected equipment to avoid interruption in supplied power. Battery power is provided, for example, to the fire alarm and criticality alarm systems.

In addition to the engineered controls supplied to keep radioactive materials out of the worker's breathing zone, workers are further protected by the use of continuous air monitors that continuously monitor the breathing zone air for radioactivity and sound an alarm if the activity exceeds a preset level. Exhaust streams from facility rooms, hoods, and gloveboxes are also monitored in this fashion after passing through their final stage of HEPA filtration. To provide a lower limit of detection than is possible with the continuous air monitors, passive air sampling, which does not have alarming capability, is also conducted in work areas and before exhaust streams are discharged from the facility (LLNL 2002r).

The proposed near-term programmatic enhancements and D&D projects would be similar to ongoing activities in the building, and their potential environmental, safety, and health impacts would be mitigated to minimal levels. Some of these projects would be designed to further minimize the impacts to workers; e.g., the enclosed transport system for Livermore Casting and Shaping Technology System would reduce potential for worker exposure to radioactive materials.

Generated Wastes and Effluents

There are five specific categories of waste that may be generated in Building 332: transuranic waste (waste with radioactive material contamination levels greater than 100 nanocuries per gram); low-level waste (all waste with radioactive materials contamination levels less than 100 nanocuries per gram); mixed waste (hazardous waste contaminated with radioactive waste); hazardous waste (hazardous waste sampled and shown to be free of radionuclides); and uncontaminated solid waste (nonhazardous, nonradioactive waste disposed of via the municipal landfill). Wastes in all of these categories are evaluated for radionuclide content before transportation to RHWM facilities.

Legacy and new transuranic waste is temporarily stored in the basement, and the individual waste drums are scanned by a segmented gamma scanner to verify radionuclide and curie content. The drums are then sent to RHWM. Plutonium-contaminated liquids are also generated by Building 332 operations and consist of cleaning or lubricating fluids and contaminated oil and aqueous solutions used in analytical and metallurgical operations. All plutonium-contaminated liquid wastes, typically in liter quantities, are either solidified prior to disposal as solid waste or retained in approved containers prior to pickup by RHWM for proper treatment, storage, and/or disposal.

Building 332's ongoing activities and near-term programmatic enhancements would increase the transuranic waste generation amounts, but the waste amounts would be well within the capacities and capabilities of the RHWM facilities. Appendix B describes how transuranic waste is managed and stored at LLNL and identifies the upcoming activities for certification and transport of this waste type to the Waste Isolation Pilot Plant.

Two 750-gallon tanks are used to collect nonradioactive aqueous laboratory wastes. The aqueous wastes may contain a small amount of acid waste such as sulfuric acid, chromic acid, phosphoric acid, fluoroboric acid, and nitric acid, and/or metal salts such as nickel, beryllium, copper, and silver. When a tank becomes full, the contents are analyzed for radioactive and hazardous contaminants. If the waste meets the criteria of the Livermore Water Reclamation Plant, it is discharged to the sanitary sewer system.

Other Building 332 waste streams include alkaline and acid solutions, including lab-packed solutions; lab-packed waste chemicals; halogenated and nonhalogenated organic solutions; empty containers; debris such as contaminated paper and rags, protective clothing, glassware, plastic ware, tubing and fittings, wood and metal parts, and HEPA filters with hazardous constituents; wastewater; residues; asbestos; cleaning solutions, including solvents; waste oil with trace gasoline, diesel, organics, and metals; and contaminated equipment. All waste streams are properly managed based on radioactive and hazardous material content.

A.2.2.33 *Building 334*

Building 334, the Hardened Engineering Test Building, is part of the Superblock, a protected area located in the southwest quadrant of the Livermore Site. Building 334 has a total area of 8,600 gross square feet and is used for three main activities (LLNL 2002bs, LLNL 2002s):

- Conducting intrinsic radiation measurements. Nonexplosive, plutonium-bearing assemblies are used in these experiments, using gamma and neutron generators in some cases to determine the occupational radiation exposure to personnel during transportation, storage, and handling of nuclear components.

- Conducting physical testing of components to various combinations of vibration, acceleration, mechanical, and thermal shock. These tests simulate the harsh conditions to which the components may be subjected over their lifetime in storage, transportation, and use.

- Performing low-level radiography of specific components.

The building has two three-story high bays used for performing tests, two control rooms, an entry and signal amplifier room, a mechanical equipment room, and supporting utilities. One test bay houses the intrinsic radiation; the other, the engineering test bay, houses the physical test equipment. Each bay is equipped with a HEPA ventilation system. The separation of bays and the independent ventilation systems ensure that events in one bay do not affect the other.

Work performed in Building 334 consists of thermal and mechanical testing, low-level x-ray radiography, and intrinsic radiation measurements using a gamma or neutron generator on occasions. Work could involve items being brought into the facility containing an array of potentially hazardous materials (LLNL 2002s).

Hazards Assessment

The hazards for Building 334 are associated with reactive materials, cryogenic materials, heat sources, high-voltage electrical systems, compressed gases, radiation-generating devices, ionizing radiation, toxic materials, and industrial hazards due to sample testing techniques. These hazards are associated with thermal and mechanical shocks and radiation measurement activities.

The release of radioactive material from the Hardened Engineering Test Building is prevented by multiple confinement barriers, including metal barriers around the radioactive source material in the intrinsic radiation bay and the engineering test bay (confinement) as well as walls and equipment enclosures (physical barriers).

When operations are ongoing in a bay, continuous air monitors are used to provide immediate warning if airborne radioactive contamination exists. If radiation levels exceed a preset level, continuous air monitors in each room sound an audible local alarm to warn bay occupants and send a signal to the alarm panels in the control rooms.

A standby generator, shared with Building 331, provides power in the event of an outage. Standby power is provided for air monitoring systems, fire and security alarms, and the lighting of the two bays (LLNL 2002s).

Generated Wastes and Effluents

This facility is used for measurement and testing only. No radioactive, hazardous, or mixed wastes are generated during normal operations in Building 334.

A.2.2.34 *Building 341*

The Building 341 Physics and Advanced Technology Facility is located in the southwest quadrant of the Livermore Site. This 44,322-gross-square-foot building contains a variety of isolated, interlocked, and remotely controlled major experimental facilities for high-energy operations. The experimental studies within the facility include the use of high-energy electrical systems and explosives, high-velocity experiments using gun systems, and development and testing of optics, laser systems, flash x-ray generators, and hydro-diagnostics equipment (LLNL 2002bh).

The experimental facilities in Building 341, where required, are designed with hardened construction, soundproofing, special ventilation, fire protection, safety interlocks, run-safe switches, and warning devices to minimize hazardous conditions to personnel (LLNL 2002bh).

Depleted uranium in metal form is used in Building 341 for a number of scientific applications other than fuel for nuclear reactors. These applications include projectiles, armor-piercing ammunition, and target materials.

Hazards Assessment

The primary hazards within this building are from work involving high-velocity projectiles, high-energy electrical storage systems, high-pressure operations, laser operations, use of toxic and radioactive materials, x-ray producing equipment, flammable gases and liquids, detonators, explosives, and high-speed rotating cameras (LLNL 2002bh).

Some of the operational and safety controls include warning light systems for hazardous operations, safety interlock systems for personnel entry, use of protective clothing and equipment, use of hazardous materials only in designated areas with equipment approved for the type of operation, remote operation of the high-speed rotor cameras, insulation and shielding of high-voltage systems, and high ventilation rates for enclosed spaces and vaults (LLNL 2002bh). Remote key-controlled firing, safety interlocks, and strict adherence to operational controls are required to prevent injuries and damage to property.

Propellant and detonators are stored in approved storage areas only, in a nonpropagating configuration. Detonator use is restricted to approved areas and these areas are electrically interlocked and equipped with physical key lockouts (LLNL 2002bh).

Operations involving radioactive material are performed in areas designed to minimize both personnel exposure and the probability of releasing radioactivity into uncontrolled areas.

There may be funding in the future for advanced armor studies. Associated hazards could include explosion, shrapnel, x-ray exposure, high-voltage shock, smoke inhalation, and loose radioactive particles. Some of the controls include interlocked doors and equipment, remote operations, containment box ventilated through HEPA filters, air monitoring, x-ray safety boxes, and electrical isolation of explosives (LLNL 2002bh).

Generated Wastes and Effluents

Hazardous wastes such as photographic materials, waste oils, gunshot, and contaminated clothing are produced in this facility as a result of gas gun operations. Explosives wastes and radioactive fragments are also produced. All wastes are handled by RHWM for proper treatment, storage, and disposal (LLNL 2002bh).

A.2.2.35 *Building 343*

Building 343, the High-Pressure Laboratory, is located in the southwest quadrant of the Livermore Site. This 25,590-gross-square-foot facility has four reinforced concrete cells used for tests and experiments with high-pressure systems up to 75,000 pounds per square inch. The high-pressure systems inside these cells can be operated remotely for burst, leak, or certification testing with liquids and inert or flammable gases. Systems tested in Building 343 include vessels and components manufactured from radioactive (depleted uranium) and toxic (beryllium) materials. Facility operations also include engineering design and fabrication of high-pressure systems (LLNL 2003n).

Hazards Assessment

Hazards that are associated with the high-pressure systems include rupture of pressurized equipment, contamination by toxic or radioactive material, or ignition of flammable gases. Facility safety procedures have been established that restrict the quantity, containment, physical state, type, and energy potential of the hazardous materials (LLNL 2003n).

Generated Wastes and Effluents

Wastes generated from this facility include hazardous waste and low-level radioactive waste contaminated with depleted uranium. Wastes are collected in designated containers in satellite accumulation areas (LLNL 2003n)

A.2.2.36 *Building 360 Complex*

The Building 360 Biological Research Complex is located in the center of the Livermore Site. The buildings in the Building 360 Complex are used in fulfilling the mission of the BBRP, which conducts basic and applied research in health and life sciences in support of national needs to understand causes and mechanisms of ill health, to develop biodefense capabilities for national and homeland security, and to improve disease prevention and lower health care costs. Activities in these facilities include general chemistry and biology research up to BSL-2, which includes work with biological agents of moderate potential hazard, such as *E. coli* K12; mouse tissues; untransformed normal human cell lines; and fixed samples of human tissue, and work with experimental animals (mice). BSL-2 includes human tumor cells and potentially infectious cells and secretions. The BSL-3 facility would handle infectious microorganisms. The Building 360 Complex building sizes and operations are summarized in Table A.2.2.36–1 (LLNL 2002an).

TABLE A.2.2.36–1.—*Summary of Building 360 Complex Operations*

Facility	Uses	Square Feet
Building 361	Biological research, recombinant DNA, sterilization of all LLNL medical waste	67,672
Building 362	Biological research	3,749
Building 363	Food toxicology	1,584
Building 364	Animal care and research	10,951
Building 365	Pathogenic microbe research, primary treatment of BSL-2 waste	8,871
Building 366	Mouse genomics research	2,620
Building 368	Animal handling, pathogen research up to BSL-3	1,500
Building 376	Machine shop	1,560
Building 377	Structural biology research, x-ray diffraction crystallography, Class 3 laser	4,333

Source: Original.
BSL = BioSafety Level; DNA = deoxyribonucleic acid; LLNL = Lawrence Livermore National Laboratory.

Hazards Assessment

The hazards associated with work in the biological research laboratories include radiological, chemical, and biological hazards. Radiological concerns include a cesium-137 irradiation facility at Building 364, with a 3,500-curie cesium-137 source, and the use in various laboratories of tritium, carbon-14, phosphorus-32, and sulfur-35. Chemical hazards include the usual laboratory chemicals and a number of toxic and carcinogenic materials. These include benzene, toluene, xylene, and phosgene, among others. Biological work includes experiments with materials up to BSL-2 (LLNL 2002an).

The planned BSL-3 laboratory would contain organisms of types, forms, and quantities that require BSL-3 controls and precautions. This would include up to 1 liter of any organism in growth media and a total of 25,000 samples of various pathogens. The facility would not contain radioactive materials, and hazardous chemical inventories would not exceed general industry criteria (LLNL 2002an).

Generated Wastes and Effluents

The Building 360 Complex generates hazardous waste; low-level radioactive waste, mostly from isotopes such as phosphorous-32, carbon-14, and sulfur-35; and mixed waste. The hazardous wastes generated include halogenated and nonhalogenated solvents, including lab-packed solutions; lab-packed waste chemicals; organics; corrosives; reactive salts; laser dyes; empty containers; debris such as contaminated paper and rags, protective clothing, glassware, plasticware, tubing, and fittings. Waste materials are collected at satellite accumulation areas and then moved to a designated waste accumulation area.

The types of waste produced by the biological analysis and recombinant DNA research include nonhazardous biological waste, biohazardous and contaminated sharps (medical) waste, and chemical waste. Biohazardous wastes include waste generated from research with RG-1 agents; i.e., agents not associated with disease in healthy human adults, and RG-2 agents; i.e. agents associated with human disease that are not transmissible by aerosols, including hepatitis and human immune deficiency virus (HIV); and from research in the planned BSL-3 laboratory with RG-3 agents; i.e., agents associated with serious or lethal human disease that can be transmitted by aerosols and for which preventative or therapeutic interventions may be available. The complex sterilizes medical waste prior to disposal as landfill waste and biohazardous sharps waste prior to incineration offsite.

Hazardous packaged waste is bagged, labeled, and transferred to the waste accumulation area. Carcinogens are packaged and transferred directly to toxic waste control. Animal carcasses are double bagged and kept in freezers until they are picked up by RHWM for disposal.

The complex also has two laboratory wastewater retention systems that are used to collect and retain dilute nonhazardous and nonradioactive rinsewaters from laboratories until analysis determines they can be discharged to the sanitary sewer. The Building 364 water retention tank receives animal cage rinsewater that may be contaminated with radioactive or hazardous materials. The Building 365 water retention tank collects water from sinks and floor drains in the seven laboratories in that building, as well as from Building 368. The retention tank effluent is sanitized before being discharged to the sanitary sewer.

A.2.2.37 *Building 378*

Building 378, the Environmental Radioactivity Analysis Laboratory, is located in the central portion of the Livermore Site. This 3,840-gross-square-foot facility comprises two wet chemistry laboratories; an instrumentation room containing alpha, beta, and gamma spectrometers; and supporting office and storage spaces.

Building 378 conducts alpha, beta, and gamma spectrometric studies on environmental samples such as plant and animal tissues. Support operations include dissection of animals, birds, and fish and sample preparation using acid or microwave digestion, ion exchange separation, electro-deposition, spontaneous deposition, or chemical precipitation.

Low-level radioactive chemical yield tracers are used in radiochemical analyses to trace and quantify analyses of interest. These may include the gamma tracers cesium-134 and strontium-85. Alpha tracers may include polonium-209, plutonium-242, and americium-243. Encapsulated beta- and gamma-emitting sources may also be used for calibration and instrument performance testing. Various radiochemical procedures are developed or modified by Environmental Radioactivity Analysis Laboratory staff as dictated by programmatic needs (LLNL 1997g).

Hazards Assessment

The primary hazards associated with Building 378 include low-level radioactive tracer solutions and sealed sources (ionizing radiation); concentrated acids and bases; toxic, flammable, and carcinogenic materials; cryogens; high-voltage electricity; and high temperatures and pressures. Controls for these hazards are specified in both facility and operational safety plans. The use of a hood is required if the operation could potentially release material into the workplace. Personnel safety is ensured by toxic materials storage and handling systems (LLNL 1997g).

Generated Wastes and Effluents

Wastes generated by Building 378 consist of small amounts of solid and liquid wastes. The hazardous and nonhazardous wastes that are produced in the facility include alkaline and acid solutions, including lab-packed solutions; lab-packed waste chemicals; nonhalogenated solutions, both organic and inorganic; empty containers; laboratory debris such as contaminated paper and rags, protective clothing, glassware, plasticware, tubing and fittings, wood and metal parts, and HEPA filters contaminated with hazardous and radioactive constituents; flammable liquids; cleaning solutions, including solvents; and contaminated equipment. Small quantities of radioactive and mixed waste may also be generated. Waste materials, both liquid and solid, are collected in containers at workplace accumulation areas in or near the laboratories where the waste is generated. The waste is segregated until collected by RHWM.

Some operations in Building 378 release small quantities of organic vapors to the atmosphere. Because the quantities of organic vapors released are small, the release of organic vapors under the worst-case condition will not exceed the ERPG value (LLNL 1997g).

A.2.2.38 *Building 379*

Building 379, the Gamma Spectrometry Facility, is a 1,500-gross-square-foot facility located in the central portion of the Livermore Site. The facility is divided into a gamma spectrometry room, containing 22 detector systems with liquid nitrogen cooling; a sample receiving bay/workshop; and a data reduction/computer room (LLNL 1997g).

Hazards Assessment

The primary hazards within Building 379 are associated with the use of electronic equipment and cryogens. Controls for these hazards are specified in both facility and operational safety plans. No radioactive unencapsulated samples or calibration standards enter the facility (LLNL 1997g).

Generated Wastes and Effluents

Waste streams generated in Building 379 consist of small amounts of solid and liquid hazardous and radioactive wastes. The hazardous wastes and nonhazardous wastes produced in the facility include laboratory debris such as contaminated paper and rags, protective clothing, glassware, plasticware, tubing and fittings, wood and metal parts, and HEPA filters contaminated with hazardous and radioactive constituents; cleaning solutions, including solvents; and contaminated equipment. Small quantities of radioactive and mixed waste may also be generated. Waste materials, both liquid and solid, are collected in containers at workplace accumulation areas in or near the laboratories where the waste is generated. The waste is segregated until collected by RHWM.

Some operations in Building 379 release small quantities of organic vapors to the atmosphere. Because the quantities of organic vapors released are small, the release of organic vapors under the worst-case condition will not exceed the ERPGs (LLNL 1997g).

A.2.2.39 *Building 381*

Building 381, the Laser Facility, is located in the north-central section of the Livermore Site. This 101,598-gross-square-foot facility consists of a two-story, three-wing office area, laser research laboratories, and a mechanical equipment area. The facility supports the ICF Program, the LS&T Program, and the NIF Project. Supporting activities involve laser R&D, x-ray calibration of ICF/NIF diagnostics, and the NIF amplifier assembly. Operations within the facility include low-energy x-ray calibration of ICF/NIF diagnostics, optical science laser facility operations, NIF front-end oscillator development; NIF preamplifier development; mercury laser; advanced laser drilling; neutron generator and advanced diagnostic development; the NIF master oscillator; preamplifier beam transport system risk mitigation testing; and Building 381 frame assembly (LLNL 2002aj).

Hazards Assessment

Building 381 is classified as a general industry facility. The primary hazards within the building include fire, electrical, exposure to laser beams and x-rays, the use of vacuum and gas pressure systems, and exposure to large and custom handling equipment. The facility is equipped with an automatic sprinkler system. Laser access is controlled by warning signs, lights, signals, intercom system, and door locks. Electrical equipment is designed with shielded cables and connectors and interlocked housing to prevent inadvertent electrical shock. Operational safety plans are followed for each experiment, and appropriate signs are posted on equipment and across doors.

The facility's radionuclide inventory is derived from sealed sources and a physical inventory of tritium targets. The current tritium inventory is about 8.5 curies, including the installed target, which is well below the storage limit of 20 curies.

Based solely on building inventory quantities, only lead and mercury exceed the reportable quantities for classification as a general industry facility. The ERPGs for lead mercury would not be exceeded in the event of a spill or fire (LLNL 2002aj).

Generated Wastes and Effluents

Wastes generated from this facility include hazardous waste and low-level radioactive waste contaminated primarily with tritium. Wastes are collected in designated containers in the satellite accumulation areas (LLNL 2002aj).

A.2.2.40 *Building 391*

Building 391, The Inertial Confinement Fusion Laser Facility, is located in the north-central section of the Livermore Site. This 186,594-gross-square-foot building provides laboratories, mechanical utility rooms, and office space for various R&D activities related to lasers. The building houses a variety of support activities for the NIF as well as the stored NOVA components; NOVA operations in Building 391 were terminated in April 1999.

The facility has 20 Sea Land containers located to the north of Building 391. There are five groups of four containers stacked two high. The containers are mainly used for storage of parts and equipment. Only one container is used for flammable and corrosive storage. A fenced laydown area on the ground level is between the five groups of containers

A number of aboveground tanks are also associated with Building 391 operations. A water purification system is located adjacent to the northwest corner and a standby power generator is located to the north of the facility on the western end. A 500-gallon, double-walled diesel tank supplies the generator. On the northeastern side of the building is a 28,000-gallon liquid nitrogen tank that supplies Building 391 and Building 381 with nitrogen gas.

Major research areas in the facility include beam control and laser diagnostics; laser peening technology; testing and development of cleaning, coating, and diagnostic techniques for large optics; development of fast-streak cameras; operation and testing of flash lamps; testing and assembly of amplifiers; fabrication of submicron-period diffraction gratings for x-rays; use of analytical x-rays; beryllium coating; and performance and reliability of the NIF power conditioning modules (LLNL 2002au).

Hazards Assessment

The primary hazards in Building 391 include fire, hazardous materials, exposure to laser beams and x-rays, high voltage, explosion of components, cryogenic systems, and vacuum and pressure systems.

Because of the many hazards present, Building 391 has several extensive operational and safety controls. These controls include an automatic sprinkler system; electrical equipment designed with shielded cables, connectors, and interlocked housings to prevent inadvertent electrical shock; access to lasers controlled by warning signs, lights, signals, and operational safeguards; engineering and operational safeguards on the vacuum and pressure systems. Operational safety plans are followed for each experiment, and appropriate signs are posted on equipment and access doors (LLNL 2002au).

Generated Wastes and Effluents

Wastes generated from this facility are hazardous wastes and are collected in designated containers in the satellite accumulation areas.

A.2.2.41 *Building 392*

Building 392, an optics laboratory, is located in the north-central portion of the Livermore Site. This 8,401-gross-square-foot facility supports the NIF Laser and Target Area Building (LTAB). Activities in Building 392 include a sol-gel coating process and photometer operations. A number of capacitors containing di(2-ethylhexyl) phthalate (DEHP) and ignitron switches containing mercury are stored in the Building 392 corporate yard (LLNL 2002ak).

Hazards Assessment

Building 392 is classified as a general industry facility. The primary hazards in this facility include high-voltage electrical systems; lasers; compressed gases; hazardous materials; e.g., flammable liquids, hydrofluoric acid, ammonia, epoxies, solvents; and industrial safety hazards. Safety documentation; e.g., integration work sheets, peer reviews, operational safety plans, and the facility safety plan, is used to help ensure personnel safety (LLNL 2002ak).

A number of large ignitron switches, which have about 3.4 pounds of mercury sealed within each, are stored in the Building 392 corporate yard. In the past 30 years of LLNL operations using ignitrons, the large ignitrons have never failed or leaked. Capacitors that contain DEHP are also stored in the corporate yard. DEHP is considered to be a very weak suspected carcinogen with low acute toxicity. Small amounts are contained in the welded, sealed case of each capacitor, with little possibility of leakage (LLNL 2002ak).

Generated Wastes and Effluents

Small quantities of liquid and solid hazardous wastes are generated from this facility. Wastes are collected in designated containers in the satellite accumulation areas.

A.2.2.42 *Building 431*

Building 431, the Accelerator Research Facility, is a 150,366-gross-square-foot, multi-use facility located in the southwest quadrant of the Livermore Site. Building 431 comprises office, shop, and laboratory space. The facility houses the experimental test accelerator (ETA)-II and the compact and underground radiography experiments. Building 431 also has a high bay that is used for preparing, modifying, and testing the NIF hardware, components, and beam enclosures (LLNL 2002bh, LLNL 2002al).

Hazards Assessment

Hazards associated with Building 431 include high-voltage/high-energy electrical systems; ionizing radiation; lasers; hazardous materials such as toxic gases, asphyxiants, solvents, and lead; magnetic fields; and industrial safety hazards. Of the hazardous materials used and stored in Building 431, all are used and stored in accordance with institutional and programmatic controls for minimizing or reducing the potential for exposure, injury, or illness.

Generated Wastes and Effluents

Small amounts of hazardous wastes are generated in this facility including solvents, spent oils, and waste streams with high concentrations of regulated metals and other industrial waste; i.e., epoxies, adhesives, etc. Waste materials, both liquid and solid, are collected in containers at the satellite accumulation areas (LLNL 2002bh, LLNL 2001am).

A.2.2.43 *Building 432*

Building 432, a mechanical shop for the NIF, is located in the south-central portion of the Livermore Site. This 34,747-gross-square-foot facility comprises laboratory, shop, and office space. Building 432 houses several laboratories for the NIF Programs Directorate. A high bay is used for developing the final optics assembly, line replacement units, loading systems, flash lamp, and slab canisters. A clean room is used to test first article equipment using a variety of mechanical manipulator systems. Other rooms conduct software development and controls hardware interfacing; fabrication, assembly, and testing with first article hardware; assembly and testing of subassemblies for line replaceable units, canisters, and skids; and assembly and testing of a variety of optical steering hardware and mechanical manipulators (LLNL 2002av). In the past, Building 432 also housed a biological safety and security laboratory that used RG-1 or nonselect RG-2 biological materials. Activities in this facility included general chemistry and biology research up to BSL-2, which included work with biological agents of moderate potential hazard such as *E. coli* K12 (DOE 2003f).

Hazards Assessment

Typical operations include the use of welding equipment, power tools, forklifts, cranes, compressed gases, and vacuum ovens. The hazards associated with work in Building 432 include chemical and biological hazards. Controls for these hazards are specified in both facility and operational safety plans.

Generated Wastes and Effluents

The operations in Building 432 generate hazardous, nonhazardous, and RG-1 and RG-2 biological wastes. Hazardous wastes and nonhazardous wastes produced in the facility include alkaline and acid solutions; both lab-packed and bulk-waste chemicals; lab-packed spent halogenated and nonhalogenated solvent solutions, both organic and inorganic; laser dyes; petroleum and mineral-based oils; empty containers; laboratory debris such as contaminated paper and rags, protective clothing, glassware, plasticware, tubing and fittings, wood and metal parts, and HEPA filters contaminated with hazardous constituents; machine shop wastes; and flammable liquids. Small quantities of radioactive and mixed wastes are also generated in this facility.

Waste materials are collected at satellite accumulation areas and then moved to a designated waste accumulation area. All wastes that contain biological materials are managed as biohazardous and sterilized prior to disposal as a best management practice.

A.2.2.44 *Buildings 435 and 446*

Building 435, the corrosion research and the NIF support facility, and Building 446, the former Yucca Mountain Program experiment facility, are located in the south-central section of the Livermore Site. Building 435 is a 54,768-gross-square-foot facility that houses wet chemistry and corrosion research laboratories (LLNL 2003f) and contains equipment to perform corrosion testing and electrochemistry, including a laser interferometer, Thompson scattering equipment, and autoclaves for sterilization (LLNL 2002bc). Building 435 houses two magnetic fusion energy experiments: the Sustained Spheromak Physics Experiment, operated by the Physics and Advanced Technology Directorate, and the Davis Diverted Tokamak, operated by the University of California, Davis, Department of Applied Science. Experiments are conducted in these facilities on the confinement and heating of plasmas as part of the U.S. Fusion Energy Program. Plasmas are formed in large vacuum vessels and studied using diagnostics including a laser interferometer and laser Thompson scattering. Building 446 is a 1,730-gross-square-foot facility that consists of a high bay, a utility room, and a microbiology/biochemistry wet laboratory. An equipment pad is located adjacent to the western side of the building (LLNL 2003f).

These facilities are used to perform material testing to determine the impact of microorganisms on engineered barriers. Operations include culture analyses of microbial communities found in environmental samples, biological corrosion testing of metal alloys, and measurement of microbiological community gas generation rates. Building 446 also houses a 5-liter and a 1,500-liter bioreactor, which could be used for cultivating microorganisms. Microbial community characterization activities include extracting total community DNA from environmental samples and using polymerase chain reaction assays to perform DNA sequence analyses that may also include the use of radionuclides for labeling experiments. Corrosion test activities involve the use of 1-liter bioreactors, in which metal alloy samples are subjected to simulated groundwater with the addition of micro-organisms. All work is currently performed at BSL-1, but the facility will be upgraded to perform at BSL-2 or below with nonselect micro-organisms (DOE 2001i).

Hazards Assessment

The primary hazards associated with Buildings 435 and 446 include ionizing and non-ionizing radiation; hazardous materials such as flammable liquids, flammable gases, toxic materials, carcinogens, reproductive toxins, corrosives, and oxidizers; compressed gases; high temperatures; and up to RG-2 nonselect microorganisms. Controls for these hazards are specified in both facility and operational safety plans (DOE 2001i, LLNL 2003f). The primary hazards for the magnetic fusion energy experiments in Building 435 are high voltage, ionizing and non-ionizing radiation, magnetic fields, compressed gases, high temperatures, and confined spaces.

Generated Wastes and Effluents

These buildings generate a small amount of solid and liquid hazardous, radioactive, and mixed waste; the magnetic fusion energy work generates small amounts of hydrocarbon-contaminated tissues for surface cleaning. Flammable or combustible wastes are stored in appropriate containers. All hazardous, radioactive, or other regulated wastes are collected in appropriate containers, labeled, and temporarily stored at a satellite accumulation area prior to treatment or disposal by RHWM (LLNL 2003f).

No biohazardous waste is generated at these buildings. Nonpathogenic concentrated isolates of naturally occurring bacteria and fungi are considered nonbiohazardous. As a best management practice, all nonhazardous and nonradioactive wastes that contain biological materials are sterilized prior to disposal (LLNL 2003f).

A.2.2.45 *Building 453*

Building 453, the Terascale Simulation Facility, is a new facility that is currently under construction in the central area of the Livermore Site. The 253,000-gross-square-foot facility will consist of two computer clean rooms and a four-story office complex. The Terascale Simulation Facility design accommodates parallel processing computer systems of increasing computational power within the same footprint and building space. As computer systems change, old equipment would be removed and replaced with current, state-of-the-art equipment. The basic building structure, components, utilities, and exterior support facilities are designed to support the maximum planned computer load through 2014.

The Terascale Simulation Facility would be capable of housing the 100-TeraOps-class (trillion operations per second) computers and networks and the data and visualization capabilities necessary to perform the simulations essential to ensuring the safety and reliability of the U.S. nuclear stockpile. Using data from past test and surrogate experiments, computer scientists would conduct three-dimensional simulations of nuclear weapon performance. Space would be available to support a weapons code development team to integrate experimental, physical, material, and computer sciences for support of stockpile stewardship requirements (DOE 1999b, DOE 2003b).

Hazards Assessment

Once built, the Terascale Simulation Facility will be a general industry facility. As such, the only hazardous materials present would be industrial cleaning agents, equipment lubricating oils, and maintenance solvents and chemicals used for maintaining the cooling system such as biocide, corrosion inhibitor, and chlorine (LLNL 2002ax). During construction, hazards will include those generally associated with typical construction activities.

Generated Wastes and Effluents

The Terascale Simulation Facility comprises offices and computing facilities only. No radioactive, hazardous, or mixed wastes will be generated during normal operations.

A.2.2.46 *Building 511*

Building 511, the Craft Shop, is located in the southeast quadrant of the Livermore Site. This 76,552-gross-square-foot facility is used as a crafts shop for electrical and mechanical equipment assembly, disassembly, and repairs.

This facility supports the Livermore Site field operations, including routine electrical equipment inspections; repair and installation in electrical/communication vaults, manholes, and trenches; repairing refrigerant tubing; disassembly, repair, and maintenance of vacuum pumps; and visual inspections, maintenance, and electrical installations in manholes and underground vaults (LLNL 2002t).

Hazards Assessment

Hazards associated with operations in this facility include potential flammable atmospheres, oxygen-deficiency atmospheres, asbestos, or polychlorinated biphenyl (PCB) oils; compressed gases; zinc or cadmium present as a plating material causing toxic fumes when exposed to flames; the use of fluorocarbon refrigerants, which when heated, break down chemically into hydrofluoric acid, hydrochloric acid, phosgene, and other toxic vapors; vacuum pumps that are contaminated with beryllium, mercury, radioactive materials, heavy metals, and toxic compounds; and electrical shock (LLNL 2002t, LLNL 2001an).

Strict operational and safety controls are followed to avoid the many hazards associated with field operations. Some of the controls include proper ventilation of manholes and vaults during work activities; cleanup of asbestos and PCB oils is performed under proper guidance from Hazards Control; personnel will not enter any confined space where tests show any flammable atmosphere or reduction of normal oxygen; refrigerants are removed from the tubing being repaired to avoid exposure to heat; safety eye protection and gloves are required; the vacuum pumps are decontaminated before being sent to Building 511 for maintenance and repairs; and the decontaminated vacuum pumps are repaired in a ventilated enclosure equipped with a catch tray or edge curbs to contain spilled oils (LLNL 2002t).

Generated Wastes and Effluents

Specific waste streams that are produced in the facility include alkaline and acid solutions, including lab-packed solutions; lab-packed waste chemicals; nonhalogenated organic solutions; empty containers; debris such as contaminated paper and rags, protective clothing, glassware, plasticware, tubing and fittings, wood and metal parts, and HEPA filters contaminated with hazardous constituents; wastewater; residues; metals; asbestos; print shop wastes; photographic wastes; flammable liquids; cleaning solution, including solvents; waste oil with trace gasoline, diesel, organics, and metals; discarded capacitors that are potentially TSCA wastes; and contaminated equipment. All contaminated wastes are handled by RHWM for proper treatment and disposal (LLNL 2002t).

A.2.2.47 *Buildings 518 and 518A*

Buildings 518 and 518A are located in the southeast quadrant of the Livermore Site. These general industry facilities are dedicated to receiving and temporarily holding U.S. Department of Transportation (DOT)-packaged containers and processing paperwork for materials that are commonly used by the public (LLNL 2000s).

Building 518, the 3,270-gross-square-foot gas cylinder dock, serves as a receiving, storage, and distribution area for compressed gas cylinders, cryogenic dewars, and bottled water. Compressed gas cylinders are generally distributed throughout LLNL within 24 hours of receipt, although the facility does have provisions for storing cylinders containing oxidizing, flammable, inert, or nonflammable gases in the Building 518 yard. Toxic gases, however, are received and distributed to the requestor on the same day; no toxic gas is held overnight. No gases are used at this facility (LLNL 2002cv, LLNL 2000s).

Building 518A, the Chem Track Facility, is 195 gross square feet and serves as a chemical receiving and barcoding area. Inbound chemicals are received in closed containers and are processed and distributed throughout LLNL within 24 hours of receipt. No radioactive, pathogenic, or explosive material is received at Building 518A. No chemicals are used or stored at this facility (LLNL 2000s).

Hazards Assessment

The hazards at Buildings 518 and 518A are primarily associated with handling compressed gas cylinders and receipt and delivery of hazardous and toxic chemicals (LLNL 2002cv, LLNL 2000s).

Generated Wastes and Effluents

These facilities are used primarily as loading, receiving, and storage areas. There is a small amount of hazardous waste generated from the cleanup of spilled chemicals. The waste is properly disposed of by RHWM (LLNL 2002cv).

A.2.2.48 *Building 519*

Building 519, the Heavy Equipment Shop, is located in the southeast quadrant of the Livermore Site. This facility is used for vehicle and equipment maintenance and repair. The total area for the building is 10,206 gross square feet (LLNL 2002cw).

Hazards Assessment

Operations at the Heavy Equipment Shop encounter common industrial hazards including using compressed gases; hazardous chemicals such as brake cleaner and other degreasing compounds; and welding, metal machining, and sandblasting (LLNL 2002cw).

Generated Wastes and Effluents

Wastes generated from routine activities at this facility include industrial oils, antifreeze, equipment cleaning chemicals, and rags. All contaminated wastes are handled and disposed of by RHWM (LLNL 2002cw).

A.2.2.49 *Building 520*

Building 520, the Pesticide Handling and Storage Building, is 400 gross square feet, located in the southeastern portion of the Livermore Site. This building is used for the storage of herbicides, insecticides, and rodenticides in varying quantities. This is a general industry facility containing materials and products that are common to the public. All chemicals are stored in a bermed area within Building 520. At any one time, about 80 percent of the materials are stored in steel cabinets. The remaining bulk materials are stored on pallets. The building is constructed of galvanized sheeting over steel framing (LLNL 2002cx, LLNL 2002cy).

Licensed personnel mix and dilute pesticides in a work area next to Building 520. All mixed pesticides are used at the Livermore Site in accordance with labeled instructions. Empty spray tanks are rinsed, and the rinsewater is sprayed out on other target areas (LLNL 2002cx, LLNL 2002cy).

Hazards Assessment

The primary hazards associated with Building 520 are herbicides, insecticides, and rodenticides. Controls for these hazards are specified in both facility and operational safety plans (LLNL 2002cy).

Generated Wastes and Effluents

All wastes generated within this facility are a result of rinsing equipment, accidental spills, and discarding outdated products. All empty pesticide containers are rinsed three times and the triple-rinsed containers are taken to the Pleasanton Refuse Transfer Station, where they are inspected by the Alameda County Agricultural Department prior to disposal. The rinsate from these containers and any equipment rinsing is either used as make-up water for future mixing and application or stored in 55-gallon containers in an adjacent waste accumulation area until picked up by RHWM. Similarly, spills are absorbed using a water-soluble absorbent and the absorbed material is used for future mixing and application or stored in an adjacent waste accumulation area until picked up by RHWM. Outdated pesticides are tagged and sent to RHWM for proper disposal (LLNL 2002cx, LLNL 2002cy).

A.2.2.50 *Building 531*

Building 531, the Custodians and Gardeners Shop, is a 12,589-gross-square-foot facility located in the southeast quadrant of the Livermore Site. This is a general industry facility containing materials and products that are common to the public. Products used by custodians and gardeners may contain hazardous materials listed in the reportable quantities, threshold planning quantities, or threshold quantities lists, but the products themselves are not listed and are available to the public (LLNL 2002ao).

Hazards Assessment

Hazards consist of chemicals, waste from unused products, and gasoline and diesel fuels. All flammable liquids are located in flammable storage lockers, outside, in a fenced and covered area adjacent to the building. The maintenance, repair, and usage of power equipment represent cut- and pinch-type hazards, which are common for this type of activity (LLNL 2002ao).

Generated Wastes and Effluents

All wastes generated within this facility are a result of accidental spills, discarding unwanted custodial or office supplies, and equipment maintenance. All wastes are handled by RHWM (LLNL 2002ao).

A.2.2.51 *Container Security Testing Facility*

The Container Security Testing Facility (CSTF) is a planned facility that would be located south of Building 531 in the southeast quadrant of the Livermore Site or other suitable onsite location. The CSTF would be used to develop methods to detect WMDs of various types in maritime cargo containers. The facility design allows a cargo container to be introduced, with a variety of contents, and evaluated while stationary, moving laterally, being lifted, or while stacked. Within the cargo container, various threat materials (or surrogates) that may be illicitly introduced to the U.S. for the purposes of terrorism would be loaded along with other contents. The configurations would then be used to challenge the best available detection methods.

The CSTF would occupy a ground footprint of 54,000 square feet, with two simple warehouse-type buildings totaling 9,200 square feet (LLNL 2002ar, LLNL 2002dh). A track passing through the facility would allow the CSTF to test detection capabilities against a moving target. The CSTF would include vaults for storing materials, neutron generators, and standard industrial radiation sources used for radiography. The CSTF would also house cargo-moving equipment, radiation-shielding material, cargo containers, and shipping materials used in testing (DOE 2003a).

Hazards Assessment

Radiological hazards would exist at the CSTF either from installed equipment or from the material provided for testing. Equipment sources would meet testing requirements established by the American National Standards Institute. Material provided for testing may include natural and depleted uranium, uranium-235, and plutonium-239. Only quantities less than the DOE Category 3 nuclear facility inventory thresholds would be allowed in other than qualified forms and sealed sources or certified DOT Type B shipping containers. All material would be handled in accordance with LLNL's ES&H safety procedures (DOE 2003a).

Chemicals used at the facility would be used in small (laboratory quantity) amounts or would represent materials encountered by the general public. Accordingly, releases due to fire would not present a hazard in excess of that routinely encountered in office, warehouse, and home fires. Potential exceptions would be limited to quantities of hazardous substances such as ammonium fluoride, ammonium chloride, arsenic, and various nuclear shielding materials; i.e., lead and cadmium. None of these would be handled in a manner conducive to significant release absent of a large fire. Additional stored materials would include ammonium dihydrogen phosphate, ammonium sulfate, sulfur (commercial fertilizer grade), ammonium sulfite, sodium chloride, hypophosphorous acid, sulfuric acid, sulfurous acid, and hydrochloric acid. Mock explosives used would present no fire hazards.

Generated Wastes and Effluents

Wastes would primarily consist of small amounts of laboratory waste containing paper, laboratory wipes, gloves, glassware, and plasticware that would be contained in laboratory packs for offsite disposal (DOE 2003a).

A.2.2.52 *Building 581*

Building 581, the NIF LTAB, is located in the northern quadrant of the Livermore Site. The LTAB is the main experimental building of the NIF and is where laser-driven experiments are conducted. This 677,757-gross-square-foot facility consists of two laser bays, two optical switchyards, a target bay, a target diagnostics areas, capacitor bays, mechanical equipment areas, control rooms, and operational support areas. Operations within the facility would include the NIF master oscillator; preamplifier maintenance; installation of line-replaceable units; activation and operation of a plasma electrode pockels cell; flash lamp firing; beam path and roving mirror diagnostics; transport spatial filter, argon operation, and cavity spatial filter initial vacuum operation; injection laser system commissioning; and alignment of the precision diagnostic system 3-omega tank and optical tables (LLNL 2002g).

Hazards Assessment

Building 581 is classified as a low-hazard radiological facility. The primary hazards during equipment installation are associated with a general industrial facility; during routine full facility operations hazards would include radiation and neutron-activated material generated during yield shots, tritium handling, lasers, high voltages, small quantities of hazardous materials, and oxygen-deficient atmospheres. Controls and mitigation features would be in place to minimize these hazards and would include concrete shielding, interlocks, personal protective equipment, and access controls (LLNL 2002g).

Generated Wastes and Effluents

Wastes generated from this facility would include hazardous waste and low-level radioactive and mixed waste, contaminated primarily with tritium. Wastes are collected in designated containers in the satellite accumulation areas. This waste would be handled and disposed of by RHWM.

A.2.2.53 *Building 621*

Building 621, the Compressed Natural Gas Station, is located in the southeast quadrant of the Livermore Site. The station is used for refueling LLNL's fleet of natural gas fueled vehicles. The pumping station has a gross area of 824 square feet. The station has two natural gas compressors designed for a working pressure of up to 4,000 pounds per square inch (LLNL 2002cg).

Hazards Assessment

The primary hazards associated with the compressed natural gas station are noise and hazardous (flammable) gas (LLNL 2002cg).

Generated Wastes and Effluents

The compressed natural gas station generates approximately 3 gallons of compressor oil annually. This waste is handled and disposed of by RHWM (LLNL 2002cg).

A.2.2.54 *Building 681*

Building 681, the Optics Assembly Building, is located in the northern quadrant of the Livermore Site. This 46,885-gross-square-foot facility supports the NIF LTAB by assembling and aligning optics in a clean environment for installation into the NIF laser system. The Optics Assembly Building has four separate rooms designated as gross mechanical cleaning, precision mechanical cleaning, optics transfer, and assembly and alignment (LLNL 2002am).

Hazards Assessment

Building 681 is classified as a general industry facility. The primary hazards during routine facility operations include lasers, electrical and mechanical equipment, small quantities of hazardous chemicals, and oxygen-deficient atmospheres. Controls and mitigation features are in place to minimize these hazards and include interlocks, personal protective equipment, and access controls (LLNL 2002am).

Generated Wastes and Effluents

Hazardous and nonhazardous wastes are generated from this facility. Hazardous wastes are collected in designated containers in the satellite accumulation areas. This waste is handled and disposed of by RHWM.

A.2.2.55 *Building T1527*

Building T1527, the Bioagent Sensing and Testing Laboratory, is located in the southwest quadrant of the Livermore Site. Operations in this 3,841-gross-square-foot facility use RG-1 or nonselect RG-2 biological materials (DOE 2003f).

Hazards Assessment

The hazards associated with work in Building T1527 include chemical and biological hazards. Controls for these hazards are specified in both facility and operational safety plans.

Generated Wastes and Effluents

The operations in Building T1527 generate hazardous, nonhazardous, and RG-1 and RG-2 biological wastes. Hazardous wastes and nonhazardous wastes produced in the facility include alkaline and acid solutions; lab-packed and bulk-waste chemicals; lab-packed spent halogenated and nonhalogenated solvent solutions, both organic and inorganic; laser dyes; petroleum and mineral-based oils; empty containers; laboratory debris such as contaminated paper and rags, protective clothing, glassware, plasticware, tubing and fittings, wood and metal parts, and HEPA filters contaminated with hazardous constituent; and flammable liquids.

Waste materials are collected at satellite accumulation areas and then moved to a designated waste accumulation area. All wastes that contain biological materials are managed as biohazardous and are sterilized prior to disposal as a best management practice.

A.2.2.56 *Building T6675*

Building T6675, the Edward Teller Education Center, is a 3,200-gross-square-foot modular classroom located adjacent to the northeast quadrant of the Livermore Site at the UC Davis Department of Applied Sciences. The education center provides educational opportunities for teachers and students. The center contains a computer room/classroom, a multipurpose wet laboratory, a server room, storage areas, and other associated rooms.

The wet laboratory is used for demonstrations typical of high school chemistry and biology courses and features mostly microscale techniques. The laboratory is equipped with a fume hood, appropriate chemical storage cabinets, and other necessary equipment (DOE 2001m).

Hazards Assessment

The primary hazards are associated with the materials used in the wet laboratory. These materials include small quantities of organic solvents, acids, bases, inorganic salts, metals, organic solids, dyes, and indicators. No heavy metals or radioactive materials are used (DOE 2001m).

Generated Wastes and Effluents

The facility generates small quantities of hazardous and nonhazardous waste. The wastes include alkaline and acid solutions, waste chemicals, spent solvent solutions, empty containers, and laboratory debris such as contaminated paper and rags, protective clothing, glassware, plasticware, and tubing and fittings. Wastes are handled and disposed of in accordance with RHWM requirements.

A.2.2.57 *Waste Management Facilities*

The RHWM facilities at the Livermore Site are discussed below. For further details, including sections on hazards assessment, see Appendix B.

Building 233 Container Storage Unit

The Building 233 Container Storage Unit (CSU) is a 1,350-gross-square-foot covered waste storage facility located next to Building 233 in the southwest quadrant of the Livermore Site. The unit is used to store radioactive, hazardous, and mixed wastes in containers (LLNL 1999g).

Building 280 Dome

The Building 280 Dome is located in the northwest quadrant of the Livermore Site. The facility was proposed and permitted to store wastes types to include solid transuranic wastes, mixed transuranic wastes, low-level wastes, and hazardous wastes. The proposal was to store up to 672 cubic yards of waste and to accept containers up to 250 cubic feet in volume. However, RHWM may not use this facility for storage purposes if the waste types can be stored in other RHWM facilities (LLNL 1999a, LLNL 1999e).

Building 513

Building 513 is located in the southeast quadrant of Livermore Site at the south end of the Building 514 area. The facility comprises approximately 5,638 gross square feet and is used to sample, treat, and store hazardous and mixed waste. Building 513 houses a solidification unit that includes a self-contained process optimization and treatability laboratory used to support ongoing process optimization for the waste management facilities. Solidification agents used are cementaceous materials such as portland cement, gypsum cement, pozzalonic flyash, aluminum and magnesium silicate clays, and resinous materials such as polystyrene, epoxides, and resorcinol formaldehyde.

Building 513 also houses a container storage unit that covers approximately 2,800 square feet of the building's total square footage. The Building 513 CSU is used for storage of liquid and/or solid hazardous, radioactive, and mixed waste (LLNL 2000t).

Building 514 Area

The Building 514 area liquid waste storage and disposal facilities are located in the southeast quadrant of the Livermore Site. This area is comprised of Building 514, the 514-1 CSU and treatment unit, the 514-2 and 514-3 CSUs, a wastewater treatment tank farm consisting of six 1,850-gallon treatment tanks, and a storage and treatment facility consisting of four 4,600-gallon storage tanks (LLNL 2000t).

Building 514 is a 2,500-gross-square-foot facility built in 1943 that houses the wastewater filtration unit and the equipment for the wastewater treatment tank farm processes. The wastewater filtration unit comprises a filter basin with rotating vacuum drum filter, filtrate and precipitate transfer pumps, a vacuum pump, a precoat system with a precoat tank and pump, and a cooling water system. The unit removes solids such as precipitates, suspended solids, or particulates from liquid hazardous and mixed wastes (LLNL 2000t). When the new Decontamination and Waste Treatment Facility (DWTF) becomes operational, RHWM plans to vacate Building 514 and return it to the institution for D&D.

The wastewater treatment tank farm is used to store and treat liquid and solid hazardous and/or mixed wastes. The types of treatment performed in this unit include neutralization/pH adjustment, oxidation/reduction, cyanide destruction, precipitation, chelation/flocculation, ion exchange, adsorption, separation, and sizing/blending. Treated waste may be shipped offsite or discharged to the city of Livermore Water Reclamation Plant via the sanitary sewer, in accordance with established discharge limits (LLNL 2000t).

The Building 514 area storage and treatment quadruple tank unit is used to store hazardous and mixed wastewaters contaminated with low concentrations of metals, oils, and solvents. Two tanks are used to manage liquid waste not regulated by the California Department of Toxic Substance Control. The remaining two tanks are used to manage mixed waste. Operations conducted in this unit include transferring, pumping, bulking, and sampling.

The Building 514-1 CSU is located in the center of the Building 514 area facility and treats aqueous hazardous and mixed wastes generated at the Livermore Site and Site 300. The Building

514-1 area CSU can store up to 7,260 gallons of liquid waste and 250 cubic feet of solid waste. The treatment units consist of a tank blending unit, portable blending unit, centrifugation unit, carbon adsorption unit, and cold vapor evaporation unit. The overall weight reduction of the waste in the treatment units is approximately 95 percent. The destruction of cyanides and cyanates and the reduction of reactives, corrosives, and oxidizers are 100 percent (LLNL 2000t).

The Building 514-2 CSU is located in the center of the Building 514 area and stores solid and liquid hazardous and mixed wastes. Waste handling operations conducted in this unit include bulking, overpacking, sampling, and transferring. Overpressurized containers are repackaged after consulting with Hazards Control. Containers are segregated according to their compatibility based on ignitability, reactivity, toxicity, and corrosivity and stored within the structure. The container storage design capacity of this unit is 10,400 gallons, and it can accommodate liquid containers of 330 gallons or solids stored in containers of 250 cubic feet (LLNL 2000t).

The Building 514-3 CSU is located in the northeast corner of the Building 514 area and stores hazardous and mixed wastes. Waste handling operations conducted in this unit include bulking, overpacking, sampling, and transferring. Overpressurized containers are repackaged after consulting with Hazards Control. The storage capacity of this unit is 22,050 gallons. The largest containers are 1,100 gallons for liquids and 250 cubic feet for solids (LLNL 2000t).

Building 612 Area

Area 612 facilities are located in the southeast quadrant of the Livermore Site and receive waste from LLNL generators. Area 612 consists of Building 612; the Area 612 portable tank storage unit, the Area 612 tank trailer storage unit; the 612-1, 612-2, 612-3, and 612-5 CSUs; the Area 612 consolidation waste accumulation area; Building 614 east and west cells CSUs; and Building 625 (LLNL 2000t).

Building 612 is located in the southwest portion of Area 612 and is 11,308 square feet. The building houses a lab packing/packaging container storage area, drum/container crushing unit, size reduction unit, and container storage unit. Operations in Building 612 include decontaminating, sampling, bulking, transferring, overpacking, lab packing, and repacking solid, liquid, and gaseous hazardous, radioactive, and mixed wastes. Ignitable, reactive, toxic, and corrosive wastes are grouped by compatibility and are segregated appropriately. These wastes are then stored for a maximum of 90 days pending onsite treatment or shipment to a permitted offsite facility for treatment, storage, or disposal. These wastes may also be sent to onsite permitted areas such as Building 612, Room 100, for up to one year (LLNL 2000t).

The Area 612 tank trailer storage unit is located in the north portion of Area 612. The unit is approximately 698 square feet and is used to store hazardous and mixed liquid wastes. The unit was designed to store tank trailers as well as portable tanks on flatbed trailers. The unit was also designed as a secondary containment for transportable treatment units used intermittently when waste is not stored at the unit. Staging, sampling, pH adjusting, bulking, and transferring are conducted at this storage facility (LLNL 2000t).

The Area 612 portable tank storage unit, located in the east portion of Area 612, is used to store liquid and solid hazardous and mixed wastes in containers, such as portable tanks. This unit is an uncovered 1,200-gross-square-foot pad that is divided into two cells by a concrete curb. The total storage capacity of the unit is 10,000 gallons; 6,000 gallons in one cell and 4,000 gallons in the other cell. Ignitable, toxic, reactive, and corrosive wastes are grouped by compatibility and are segregated appropriately within this unit (LLNL 2000t).

The 612-1 CSU is located in the northwest portion of Area 612. This unit is used to store solid hazardous and mixed wastes. No wastes containing free liquids are allowed in this unit. The 612-1 CSU comprises approximately 9,600 square feet of surface area and was designed to store a maximum of 1,422 cubic yards of waste. Approximately two-thirds of the facility is covered by tents and the remainder is open (LLNL 2000t).

The 612-2 CSU is located in the east portion of Area 612. This unit is used to store hazardous, mixed, and biohazardous wastes. The 612-2 CSU comprises approximately 1,400 square feet of surface area. Waste handling operations conducted in this storage area include staging, sampling, pH adjusting, lab packing, overpacking, bulking, and transferring (LLNL 2000t).

The Building 612 consolidation waste accumulation area is located in the southwest corner of Area 612 and is used to store waste for a maximum of 90 days. This unit is used to store liquid and solid hazardous and mixed wastes in containers, such as portable tanks. This unit is a covered 4,000-gross-square-foot pad. Ignitable, toxic, reactive, and corrosive wastes are grouped by compatibility and are segregated appropriately within this unit. The storage capacity of this unit is 47,520 gallons of waste (LLNL 2000t).

The Building 612-5 CSU is located in the southeast corner of Area 612 and is used to store solid hazardous and mixed wastes. No wastes containing free liquids are allowed in this unit. The 8,300-gross-square-foot partially covered facility is used to store ignitable, toxic, reactive, and corrosive wastes after they are grouped by compatibility and segregated. The unit has a container storage capacity of 995 cubic yards of solid mixed wastes (LLNL 2000t).

Building 614

The Building 614 CSU occupies the eastern half of Building 614 and is located in the southeast portion of Area 612. Building 614 has a surface area of approximately 1,188 square feet. The east cell unit is used to store liquid, solid, and gaseous hazardous and mixed wastes and has a storage capacity of approximately 3,520 gallons of waste material. Additional operations include sampling, bulking, repackaging, transferring, overpacking, pH adjusting, and lab packing of small quantities of compatible wastes. The west cell is used to store hazardous, radioactive, and mixed wastes. This unit can be used to store liquid, solid, or gaseous wastes. The unit also performs lab packing, sampling, bulking, transferring, overpacking, and pH adjusting. The storage capacity of the west cell unit is 672 gallons of waste. Both east and west cell units group ignitable, toxic, reactive, and corrosive wastes by compatibility and are appropriately segregated (LLNL 2000t).

Building 625

Building 625 is approximately 4,800 gross square feet and is located in the north portion of the 612 Area. The building is divided into east and west areas and is used to store hazardous wastes, radioactive wastes, mixed wastes, TSCA regulated wastes, California-only regulated wastes, transuranic wastes, and mixed transuranic wastes. This building can be used to store liquid and solid hazardous wastes. Toxic, reactive, and corrosive wastes are segregated by compatibility and stored within this unit. The facility has a total storage capacity of 42,416 gallons (210 cubic yards) (LLNL 2000t).

The Decontamination and Waste Treatment Facility

The DWTF is located in the northeast corner of the Livermore Site. The DWTF comprises Buildings 693, 693 Annex, 695, 696, and 696R.

Buildings 693 and 693 Annex comprise approximately 9,600 gross square feet and are used for hazardous waste storage (LLNL 1996c). Building 693 was constructed to replace the Area 612-3 drum/container storage unit. The unit is used to store *Resource Conservation and Recovery Act* (RCRA) and Department of Toxic Substances Control-regulated hazardous and mixed wastes as well as TSCA-regulated waste and transuranic waste. The unit stores liquid, solid, and gaseous wastes and has a storage capacity of approximately 84,470 gallons of waste material. Additional operations include sampling, bulking, repackaging, transferring, overpacking, pH adjusting, and lab packing of small quantities of compatible wastes (LLNL 2000t). The Building 693 Annex houses materials such as corrosives, highly toxic materials, and irritants that are health hazards. A roll-off pad and freezer pad are west of the Building 693 Annex.

Building 695 consists of approximately 33,000 gross square feet of floorspace used for office space, the liquid waste process area, and the reactive materials area. The liquid waste process area stores and treats radioactive, mixed, and hazardous waste that includes materials such as corrosives, highly toxic materials, and irritants. The liquid waste process area houses a tank farm for storing and treating wastewater, evaporators, a wastewater filtration module, a bulking station, a carbon adsorption unit, and a waste blending station. The reactive materials area includes the reactive waste processing room and the reactive materials cell. The building also houses analytical equipment including a gas chromatograph/mass spectrometer, x-ray fluorescence spectrometer, and dry electrolytic conductivity detector for real-time radiological, metals, and volatile organic compounds analyses to aid in treating mixed and radioactive wastes and developing improved treatment processes. The facility has a filtered ventilation system to reduce emissions. The facility includes a firewall between the operations.

Building 696 consists of 21,381 gross square feet and houses the solid waste processing area, approximately 10,000 square feet, and the radioactive waste storage area (Building 696R). The facility is divided into three areas: a receiving/classification room, a solid waste processing room, and an airlock. The processing room contains a transuranic repackaging unit and a size reduction unit (LLNL 1996d).

Building 696R is formerly the radioactive waste storage area portion of Building 696, is approximately 9,600 square feet, and is used for the storage of transuranic waste and California-only mixed waste until it can be shipped offsite. Operations include loading, unloading, staging, storing, banding, possible overpacking, and periodically visually inspecting. Containers are not opened in this facility (LLNL 2002da).

A.2.2.58 *Security, Medical, and Emergency Response Facilities*

Building 271 Security Facility

The Security Facility, Building 271, is located in the central portion of the Livermore Site. This 17,278-gross-square-foot facility houses routine security and emergency response services. The Safeguards and Security Program is designed to establish an effective system of safeguards and security measures, to maintain employee security awareness and training, and to monitor system procedures and plans to keep consistent with NNSA regulations.

Routine security services include access controls, fixed access, surveillance points, random vehicle and foot patrols, response elements, and response team elements. Emergency response services provide contingency plans for work stoppages, bomb threats, natural disasters, site-wide evacuations, callout procedures, satellite command center activation procedures, executive protection, SNM alarm response procedures, non-SNM response procedures, and civil disorders.

Building 663 Medical Facility

The Medical Facility, Building 663, is located in the eastern portion of the Livermore Site. This 24,784-gross-square-foot building houses a comprehensive occupational health program designed to provide optimal clinical and preventive medical support for the employees at LLNL. Services provided include treatment for occupational and minor nonoccupational illnesses and injuries; emergency care, stabilization, and transfer; return-to-work assistance; multidisciplinary work-site inspections regarding health hazards and environmental conditions; medical surveillance, qualification, and fitness-for-duty examinations; educational programs; health promotion services; physical therapy; decontamination and treatment for chemical or radiological exposures; and employee assistance services.

The Health Services Department provides services in compliance with all applicable state and Federal laws and accepted standards of medical and nursing practice. Injuries and illnesses are reported to the Health Services Department during working hours. The LLNL Fire Department provides ambulance services 24 hours a day, 7 days a week.

Biological wastes generated from this facility are defined as medical waste and include needles, syringes, gauze, gloves, and other materials that could be contaminated with infectious agents. These wastes are transported to BBRP at Building 361 for autoclaving. All wastes are handled by RHWM for proper disposal.

Buildings 313 and 323 Emergency Response Facilities

The emergency response facilities include the LLNL Fire Department Emergency Dispatch Center in Building 313; the Fire Station, Building 323; and an emergency operations command center and a number of operation support centers located throughout LLNL. In case of an emergency, telephone communications link the command center with the operation support centers. There are additional radio communications as backup for the redundant phone communications. (Refer to Appendix I for details on the emergency planning and response procedures.) Buildings 313 and 323 are located in the southwest quadrant of the Livermore Site; the sizes of these facilities are 4,444 square feet and 18,555 square feet, respectively (LLNL

1999f). The LLNL Public Affairs Office, in agreement with the Alameda County Office of Emergency Services, may activate a joint information center at the offsite emergency services offices in Dublin, California. The center, operated by LLNL public affairs office, provides emergency response agencies with a central location for release of emergency public information in the event of an LLNL emergency with potential for offsite consequences.

A.2.2.59 *Offsite Leased Properties*

LLNL conducts limited activities at various offsite properties. The nearby offsite properties are shown in Figure A–3. LLNL-related operations contribute little, if any, environmental effects at these sites. The facilities are briefly described below.

- The Arroyo Mocho Pump Station, located about 6 miles south of the Livermore Site, is the Livermore Site's primary source of water. The pumping station lifts water from the city of San Francisco's Hetch Hetchy Aqueduct to the surface. This water then flows by gravity to the Livermore Site via storage tanks located at SNL/CA.

- Patterson Pass Road site in Livermore, California, is a warehouse and staging area for the NIF Program. The total leased space is approximately 52,000 square feet.

- The Almond Avenue Site in Livermore, California, is a childcare facility. The total leased space is approximately 9,200 square feet.

- The Graham Court site in Livermore, California, is a storage warehouse used by DNT and NAI. The total leased space is approximately 14,300 square feet.

A.2.3 No Action Alternative, Livermore Site

The No Action Alternative would include approved interim actions; facility construction; facility expansion or modification; and facility decontamination, decommissioning, and demolition, for which environmental analysis and documentation already exist. Projects and programs associated with the No Action Alternative at the Livermore Site are described in Sections A.2.3.1 through A.2.3.26. Operational modifications to existing programs and projects involving new facilities or maintenance are summarized in Table A.2.3–1, and Figure A.2.3–1 shows the locations of these projects. A list of all deactivation and D&D projects at the Livermore Site is provided in Table A.2.3–2. Projects at Site 300 are described in Section A.3.

TABLE A.2.3–2.—*Livermore Site Deactivation, Decommissioning, and Demolition Projects (continued)*

Facility Number	Facility Name	Square Feet	Waste Generation (LLW, MLLW, transuranic, solid sanitary waste, etc.)[j] (ton)
6525	Visitor Center Auditorium	960	0.48
6526	Offices	2,513	1.2565
6527	Offices	2,100	1.05
6575	Offices	1,407	0.7035

Source: DOE 2003b.
[a] Building 412 D&D generated wastes includes 8 tons LLW, 2 tons hazardous waste, and 4.5 tons industrial waste.
[b] Building 513 D&D generated wastes includes 0.75 ton LLW, 0.5 ton hazardous waste, and 1.5 tons industrial waste.
[c] Building 514 D&D generated waste includes 0.5 ton LLW, 0.5 ton hazardous waste, and 1.5 tons industrial waste.
[d] Building 280 D&D generated waste includes 2 tons LLW, 0.25 ton hazardous waste, and 0.42 ton industrial waste.
[e] Building 162 D&D generated waste includes 1 ton LLW, 1 ton hazardous waste, and 8 tons industrial waste.
[f] Building 212 D&D generated waste includes 2 tons LLW, 2 tons hazardous waste, and 5 tons industrial waste.
[g] Building 251 D&D generated waste includes 10 tons LLW, 2 tons transuranic, 2 tons hazardous waste, and 1 ton industrial waste.
[h] Building 419 D&D generated waste includes 1 ton LLW, 1 ton hazardous waste, and 2 tons industrial waste.
[i] Not available. Data will be in separate NEPA documentation for the Facility
[j] In addition to Facility, D&D projects, routine deactivation of laboratories and equipment would generate 5 tons/year solid hazardous waste, 2 tons/year mixed waste and 10 tons/year of LLW.
D&D = decontamination and decommissioning; EPD = Environmental Protection Department; LLW = low-level waste; MLLW = mixed low-level waste; NEPA = *National Environmental Policy Act*; ORAD = Operations and Regulatory Affairs Division; RHWM = radioactive and hazardous waste management; TSDF = treatment, storage, and disposal facility.

A.2.3.1 *National Ignition Facility*

The NIF conventional facilities construction is complete. Completion of the systems leading to full operation in fiscal year (FY) 2008 is in progress. In operation, the NIF would perform fusion ignition, high energy density, and radiation effects experiments in support of stewardship of the Nation's stockpile of nuclear weapons and fusion energy and applied sciences objectives. The LTAB, Building 581, the main experimental building of the NIF, is where laser-driven experiments would be conducted. The LTAB consists of two laser bays, two optical switchyards, a target bay, target diagnostics areas, capacitor bays, mechanical equipment areas, control rooms, and operational support areas. The LTAB would provide an optically stable and clean environment and provide sufficient shielding against prompt radiation and residual radioactivity. A 192-beam, neodymium glass laser would be housed in the LTAB. The laser would deliver laser light to small fusion targets mounted in a vacuum chamber. The NIF is also described in Section A.2.2.52.

A.2.3.2 *BioSafety Level 3 Facility*

The BSL-3 Facility, Building 368, would be a 1,500-gross-square-foot laboratory and office complex located in the Building 360 Complex area. The facility is designed to accommodate work on detection and counter-terrorism technologies, and would be used for environmentally safe and physically secure manipulation and storage of infectious microorganisms. The facility would have the unique capability within NNSA to perform aerosol studies to include infectious agents or biologically derived toxins. The facility would more effectively use and capitalize on LLNL's existing onsite facilities, expertise, and capabilities and would also ensure the necessary quality, integrity, and security of microbiological work (NNSA 2002a). The facility is also described in Section A.2.2.36.

A.2.3.3 *Terascale Simulation Facility*

This project provides for the design, engineering, and construction of the Terascale Simulation Facility, Building 453. The new facility would be capable of housing future computers required to meet the Advanced Simulation Computing Program. From its inception, the Terascale Simulation Facility has been designed to enable very-large-scale computing simulations essential to ensuring the safety and reliability of U.S. nuclear stockpile. The Terascale Simulation Facility would house the computers, networks, data, and visualization capabilities necessary to store and understand the data generated by the most powerful computing systems in the world. The facility would house the 100-Teraflops (trillion operations per second)-class computers and networks. The facility would be approximately 253,000 square feet and comprise a multistory office tower with an adjacent computer center (DOE 1999b, DOE 2003b). The facility is also described in Section A.2.2.45.

A.2.3.4 *Superblock Stockpile Stewardship Program Operations*

Several Stockpile Stewardship Programs will be conducted in the LLNL Superblock. These include Pit Surveillance, Shelf Life, Enhanced Surveillance, W80 Canned Sub-Assembly, Emergency Responses, W88 Stockpile-to-Target Sequence Testing, and disassembly and feed preparation demonstrations. Full implementation of these projects, will become constrained in the future by the existing administrative limit of 700 kilograms of fuel-grade equivalent plutonium unless a disposition pathway becomes available. NNSA is working on a long-term comprehensive solution for disposal of excess plutonium. These operations would have to be modified or curtailed if a disposition pathway is not established for plutonium.

A.2.3.5 *Container Security Testing Facility*

The CSTF is a planned facility that would be located south of Building 531 in the southeast quadrant of the Livermore Site or other suitable onsite location. The CSTF would develop methods to detect WMDs of various types in maritime cargo containers. The CSTF would occupy a ground footprint of approximately 54,000 gross square feet, with two simple warehouse-type buildings totaling approximately 9,200 square feet (LLNL 2002ar, LLNL 2002dh). A track passing through the facility would allow the CSTF to test detection capabilities against a moving target. The CSTF would include vaults for storing materials, neutron generators, and standard industrial radiation sources used for radiography. The CSTF would also house cargo moving equipment, radiation shielding material, cargo containers, and shipping materials used in testing (DOE 2003a). The facility is also described in Section A.2.2.51.

A.2.3.6 *East Avenue Security Upgrade*

The East Avenue security upgrade project was initiated to administratively control a portion of East Avenue between South Vasco and Greenville Roads. The project includes controlling access to the approximately 1 mile of roadway by installing security posts and vehicle barriers at both ends of the roadway. The controls restrict public access to the roadway on either a temporary or permanent basis to improve security at the Livermore Site and SNL/CA. A visitor kiosk at the west end of East Avenue, at Vasco Road, and a shared shipping and receiving truck inspection facility to serve both LLNL and SNL/CA at the east end of East Avenue, at Greenville Road, will also be constructed (DOE 2002i).

A.2.3.7 *Central Cafeteria Replacement*

The replacement for the central cafeteria is under construction and is located north of the Drainage Retention Basin and southeast of the existing E-7 parking lot. The 16,300-gross-square-foot facility will accommodate food preparation and dining and can be used for meeting rooms. This facility will serve 1,400 meals per day with a seating capacity of 600 (DOE 2002a).

A.2.3.8 *International Security Research Facility*

Building 140, the International Security Research Facility (ISRF), is a new 64,000-gross-square-foot, two-story building currently under construction on the west side of the Livermore Site, adjacent to and north of Building 132. The ISRF will provide enhancements in information management, optical-fiber networking, storage and retrieval, and real-time communications with NNSA and the intelligence community. The ISRF will contain sensitive compartmented information facilities (DOE 2000a).

A.2.3.9 *Waste Isolation Pilot Plant Mobile Vendor*

Transuranic waste will be transported in Transuranic Packaging Transporter-II (TRUPACT-II) containers from LLNL to the Waste Isolation Pilot Plant for disposal. In an effort to expedite the removal of transuranic waste from the Livermore Site, a Waste Isolation Pilot Plant-qualified mobile contractor will prepare and ship more than 1,000 drums of transuranic and mixed transuranic waste to Waste Isolation Pilot Plant. This work will be initiated in FY2004 (DOE 2003g).

A.2.3.10 *Engineering Technology Complex Upgrade*

The Engineering Technology Complex upgrade project will revitalize and enhance capabilities of facilities and equipment and consolidate existing research, prototype fabrication, and metrology activities in the Building 321 complex. The scope of this project includes facility upgrades to correct code compliance issues, consolidation and reorganization of laboratories and shops, and replacement of outdated equipment. When completed, the Engineering Technology Complex upgrade will consolidate manufacturing functions into one contiguous complex, which will improve operation efficiency and production quality, enhance scientific research, and reduce operating costs (DOE 2002c, DOE 2003b).

A.2.3.11 *Tritium Facility Modernization*

The Tritium Facility modernization project will renovate and modify approximately 7,000 square feet of Building 331 laboratory and laboratory support floorspace to install and operate a modern hydrogen isotope research capability. Adding this capability supports the Stockpile Stewardship Program by providing necessary infrastructure for high-energy density physics weapons effects and tritium/materials R&D. This capability is necessary to enable LLNL programs to meet mission objectives in stockpile stewardship and energy research. Tritium throughput would gradually increase, over a 9-year phase-in period, from about 3.5 grams per year to 25 grams per year, with a corresponding increase in operational emissions from 30 curies per year to approximately 210 curies per year (DOE 2003j). The increase in emissions would be far below the historical releases described in the 1992 LLNL EIS/EIR (LLNL 1992a).

This project includes cleanup, decontamination, and removal of tritium-contaminated equipment and remodeling activities; e.g., painting and tile removal, in various rooms in the northern end of the building. This project may include the construction of a 6,000-gross-square-foot staging, storage, and maintenance facility on the east side of Building 331 (DOE 2003j).

A.2.3.12 *Advanced Materials Program*

The Advanced Materials Program, a laser isotope separation program in support of science-based stockpile stewardship, involves deploying a solid-state laser system, used as part of a larger system, capable of separating isotopes of a desired element. LLNL had developed this capability in the past; however, the copper vapor laser system that the solid-state laser system is replacing required large amounts of room, support equipment, and cooling. In addition, the old copper vapor lasers used large amounts of hazardous chemicals. The Advanced Materials Program will seek to use new solid-state lasers to duplicate and improve the performance of the old system. Another purpose of this project is to maintain and pass on the skills and technology learned in the past efforts.

A.2.3.13 *BioSafety Laboratories*

This project consists of siting, constructing, modifying, and operating microbiological or biomedical R&D facilities at the Livermore Site. These BioSafety laboratories will explore the detection, response to, and avoidance of biological effects to humans, agriculture, facilities, or the environment from pathogens. Two types of experimental facilities are planned under this project. The first would use RG-1 or nonselect RG-2 biological materials, but would exclude activities with the potential for aerosol production. The second type of experimental facility would use RG-1 and RG-2 biological materials or toxins of biological origin (or synthetic versions). The second type of experimental facility would include certain levels of activity with the potential for aerosol production, but would exclude outdoor aerosol testing and uncontrolled indoor release of materials or toxins of biological origin. Aerosolization experiments involving RG-2 materials, which are also select agents, would be limited to biomaterials that are attenuated or nonvirulent. Initial locations for the BioSafety Laboratories and planned activities are identified in Table A.2.3.13–1.

All biological agents would be managed in accordance with the *Center for Disease Control* [CDC] *and Prevention BioSafety in Microbiological and Biomedical Laboratories Guidelines*. The project would not include any activities involving production quantities or concentrations of biological materials. Project activities would be conducted at BSL-1 and BSL-2. No work above BSL-2 would be performed in these facilities (DOE 2003f, DOE 2003i).

TABLE A.2.3.13–1.—*Summary of BioSafety Laboratory Locations and Activities*

Facility	Experiments with No Possibility of Aerosol Production	Experiments with Possibility of Aerosol Production
Building 132N	Yes	Yes
Building 132S	Yes	Yes
Building 151	Yes	Yes
Building 153		Yes
Building 154	Yes	Yes
Building 190	Yes	
Building 235	Yes	Yes
Building 241	Yes	Yes
Building 281	Yes	
Building 432	Yes	
Building 435	Yes	Yes
Building 446	Yes	
Building 8545	Yes	Yes
Building T1527	Yes	Yes
Building T4352	Yes	Yes

Source: Original.

A.2.3.14 *Reclassify Building 446 as a BioSafety Level 2 Facility*

Building 446 is located in the south-central portion of the Livermore Site, just south of the Cryogen Farm. Building 446 is a 1,730-gross-square-foot facility, containing 1,627 square feet of laboratory space. It contains a bioreactor that has not been used in 4 years, two large autoclaves, a biosafety cabinet, and two fume hoods (LLNL 2003ao). Building 446 is currently classified as a BSL-1 facility. This project would reclassify Building 446 as a BSL-2 facility in order to use the bioreactor in biochemical research using RG-1 and RG-2 biological materials. Activities in Building 446 would include general chemistry and biology research up to BSL-2, which would include work with biological agents of moderate potential hazard such as *E. coli* K12. BSL-2 work would exclude human tumor cells and potentially infectious cells and secretions and any work with potential for aerosolization of RG-2 materials.

A.2.3.15 *Remove and Replace Offices*

This project consists of removing, relocating, and replacing of temporary facilities. These facilities consist of trailers and modular units that house temporary offices. This action would affect office space for approximately 150 persons per year (approximately 20,000 square feet per year) for the foreseeable future and would include buildings at both the Livermore Site and Site 300. The facilities would be replaced by modular or permanent structures in previously developed areas and would include site preparation and construction of new parking areas or improvement to existing parking areas.

A.2.3.16 *Westgate Drive Improvements*

Currently, during peak traffic periods, there is a backup of vehicles turning from Vasco Road onto Westgate Drive. This project consists of widening Westgate Drive to relieve traffic congestion on Vasco Road. The roadwork would include a LLNL standard street section. This includes a sidewalk on one side, storm drainage, and street lighting.

A.2.3.17 *Extend Fifth Street*

This project consists of road repairs along Fifth Street as well as extending Fifth Street west to West Perimeter Drive and east to Inner Loop Road. The roadwork would include a LLNL standard street section with sidewalks, storm drainage, and street lighting. The security kiosk currently located on Avenue B, north of Fifth Street, would be relocated south along Avenue B to a new location on the north side of Third Street. The related fence and security access/alarm issues necessary to relocate the kiosk are also included in the scope of this project. The project would improve the condition of the existing roadway, improve traffic circulation on the west side of the Livermore Site, and enhance future building sites in the vicinity of the Fifth Street extension (DOE 2003b).

A.2.3.18 *Superblock Security Upgrade*

The Superblock security upgrade consists of a series of projects to add physical barriers to protect the integrity of the NMTP facilities; e.g., Buildings 239, 331, 332, 334, and 335. The Safeguards and Security Department staff are continuously evaluating Superblock to provide greater security to the facilities, workers, and the public. No physical building additions or new buildings are considered as part of the planned security upgrades.

A.2.3.19 *Site Utilities Upgrade*

Significant replacements and life-extension improvements, over and above normal repair by replacement, are required for LLNL's utility systems at the Livermore Site and Site 300. The scope of the project includes various upgrades to mechanical utilities, including equipment and systems replacement at both low-conductivity water stations; upgrades to the compressed air plant; and upgrades to the potable water system and a transmission line looping system at Site 300. The site utilities upgrade also includes a subproject to convert approximately 7,700 circuit feet of overhead 13.8-kilovolt electrical distribution lines at the Livermore Site to underground, replace 16 overhead distribution transformers with pad-mounted units, and install 13.8-kilovolt feeders and a duct bank to allow looping of feeders to other load grid switchgear (area substations) (DOE 2003b).

A.2.3.20 *Protection of Real Property*

This project protects the maintenance and integrity of many critical facilities at LLNL to ensure that programmatic work can proceed without risk of serious damage to either the buildings themselves or the work effort. This project includes Buildings 111, 113, 121, 141, 194, 231, 241, 251, 321, 332, and the reroofing package for Building 281 (DOE 2003b).

A.2.3.21 *Building 298 Roof Replacement*

Building 298 is a 20-year-old radiological laboratory/diagnostic facility housing the NIF target physics activities and is vitally important to the NIF project and experiments in the laser facility. This project consists of removing the existing 47,000-gross-square-foot roof; seismically bracing and repairing the roof and subroof as necessary, installing of new roof members, platforms, and flashing for all roof-mounted mechanical and HVAC equipment; abating lead and asbestos on the roof; and replacing skylight covers and outdated ducting (DOE 2003b).

A.2.3.22 *Plutonium Facility Ductwork Replacement*

The Building 332 Plutonium Facility ductwork replacement project replaces an existing 40-year-old glovebox exhaust system that serves 12 laboratories (DOE 2003b).

A.2.3.23 *Special Nuclear Material Tests with Optical Science Laser*

This DNT project would use the Optical Science Laser Laboratory in Building 381 for an ongoing material study. The study uses encapsulated SNM for stockpile stewardship evaluations.

A.2.3.24 *Building 292 Cleanup*

Building 292 is a 23-year-old permanent building used as an environmental laboratory housing the Expedited Technology Demonstration Project. This 15,828-gross-square-foot facility consists of offices, laboratories, and service shops. The cleanup involves cleaning up tritium-contaminated targets and the machining rooms for future use.

A.2.3.25 *Deactivation, Decommissioning, and Demolition Projects*

This project will D&D 20 excess facilities at the Livermore Site, encompassing 234,443 gross square feet.

Facility deactivation may include disposition of stored or surplus materials that may be potentially contaminated. These materials and equipment are designated as legacy items, meaning there is no identified sponsor or program. Most legacy materials are materials that were placed in storage or set aside for a future need that never materialized.

Decontamination and Decommissioning

D&D may include deactivation, decontamination, decommissioning, or demolition. Deactivation is the process of placing a facility in a stable and known condition, including the removal of readily removable hazardous and radioactive materials, to ensure adequate protection of the worker, public health and safety, and the environment. Decommissioning takes place after deactivation and includes surveillance and maintenance, decontamination, and/or dismantlement. Decontamination is the removal or reduction of residual radioactive and hazardous material. Demolition is the destruction and removal of facilities or systems from the construction site.

Deactivation support activities may include material abatement, characterization, spot decontamination, material containment, spill cleanup, waste packaging, and disposal. Buildings that are obsolete and too expensive to rehabilitate will undergo demolition. The demolition effort would include electrical and mechanical isolation from the LLNL utility grid, sampling for contamination, characterization and proper disposal of all subsystems and components, and dismantling and disposal of the structures. Where feasible, building materials that could be recovered may be segregated and transported offsite for recycling.

The list of excess facilities, including gross square footage and estimated waste generation, is provided in Table A.2.3–2.

A.2.4 Proposed Action, Livermore Site

The Proposed Action at the Livermore Site would include all the projects and programs described under the No Action Alternative (Section A.2.3) and the additional projects and programs described in Sections A.2.4.1 through A.2.4.20. Proposed Action projects and programs are listed in Table A.2.3–1. Figure A.2.3–1 shows the locations of these projects.

A.2.4.1 *Use of Proposed Materials on the National Ignition Facility*

In 1996, the programmatic impacts of conducting DOE/NNSA's Stockpile Stewardship and Management Program at all NNSA sites were evaluated in the *Stockpile Stewardship and Management Programmatic Environmental Impact Statement* (SSM PEIS). The SSM PEIS Record of Decision (ROD) documented the decision to construct and operate the National Ignition Facility at LLNL. In 1997, the Natural Resources Defense Council (NRDC) and 39 other organizations brought suit against DOE in *NRDC v. Peña*, Civ. No. 97-936(SS) (D.D.C.), challenging the adequacy of the SSM PEIS, partially on the basis that DOE should have analyzed conducting experiments on the NIF using plutonium, other fissile materials, fissionable materials, and lithium hydride. DOE maintained that the use of these materials were not reasonably foreseeable at that time. In August 1998, the judge in the lawsuit issued a Memorandum Opinion and Order that dismissed the plaintiffs' case. The Memorandum Opinion and Order provided in Paragraph 6 that:

> No later than January 1, 2004, DOE shall (1) determine whether any or all experiments using plutonium, other fissile materials, fissionable materials other than depleted uranium (as discussed in the Supplement Analysis for the Use of Hazardous Materials at the NIF Experiments, A.R. doc. VIIA-12), lithium hydride, or a Neutron Multiplying Assembly (NEUMA), such as that described in the document entitled Nuclear Weapons Effects Test Facilitization of the National Ignition Facility (A.R. doc VII.A-4) shall be conducted at the NIF; or (2) prepare a Supplemental SSM PEIS, in accordance with DOE NEPA regulation 10 C.F.R.1021.314, analyzing the reasonably foreseeable environmental impact of such experiments. If DOE undertakes the action described in subpart (2) of this paragraph, DOE shall complete and issue the Supplemental SSM PEIS and the Record of Decision based thereon within eighteen (18) months after issuing a notice of intent to prepare the Supplemental SSM PEIS.

In November 2002, the NNSA Deputy Administrator for Defense Programs approved proposing experiments on the NIF using plutonium, other fissile materials, fissionable materials, and lithium hydride (Crandall 2002). NNSA has chosen to use the LLNL SW/SPEIS as the mechanism for complying with the court's instruction to prepare a supplemental SSM PEIS. The inclusion of this supplemental SSM PEIS in the LLNL SW/SPEIS ensures timely analysis of these proposed experiments within the environmental impacts being evaluated for the continued operation of LLNL. In any ROD to be issued, NNSA will address decisions on the use of any or all of these materials in NIF experiments within the context of continuing LLNL operations.

A.2.4.2 *Increased Administrative Limits for Plutonium in the Superblock*

In the 1992 LLNL EIS/EIR, a primary goal of LLNL was to reduce the plutonium inventory to 200 kilograms through offsite disposition of significant portions of the inventory. This goal was partially achieved by relocating approximately half of the excess material offsite; however, DOE facilities were unable to accept all materials identified to be shipped. In 1999, DOE prepared a supplement analysis that reexamined future program requirements at LLNL and identified the need to modify certain radioactive material limits established in the 1992 LLNL EIS/EIR. The 1999 supplement analysis confirmed the need for an administrative limit of 700 kilograms of plutonium to provide for continued LLNL support of the Stockpile Stewardship Program.

NNSA continues to rely on LLNL to meet its Stockpile Stewardship Program mission objectives. These objectives include campaigns relating to pit manufacturing and certification, advanced radiography, dynamic materials testing, materials shelf life experiments, and enhanced surveillance research. These NNSA-assigned campaigns and programs require continued and increasing use of plutonium. NNSA is working on a long-term solution for disposal of plutonium, but no pathway for LLNL to dispose of excess plutonium currently exists, requiring an increase in the plutonium administrative limits. Therefore, NNSA would increase the administrative limit for fuel-grade equivalent plutonium to 1,500 kilograms from the existing 700 kilograms. The limit for enriched uranium would remain unchanged at 500 kilograms.

A.2.4.3 *Integrated Technology Project in the Plutonium Facility*

Science-Based Stockpile Stewardship and Management Program (SBSSMP) experiments are needed to increase the understanding of the complex physics and behavior of materials in nuclear weapons and ultimately to certify the efficacy of the Nation's aging stockpile. Accurate, theoretical, scientific, and experimental data are required to validate the computer models of the weapon performance. SBSSMP experiments involve the use of both surrogate and actual materials that would be used in the weapon system.

The Advanced Materials Program is the development and demonstration of the Atomic Vapor Laser Isotope Separation (AVLIS) technology. The Integrated Technology Project (ITP) is a follow on activity to the Advanced Materials Program to produce material to augment the current inventory of special nuclear materials (e.g., plutonium enriched uranium) for use in SBSSMP experiments. The ITP would not proceed until the Advanced Materials Program demonstrations are complete. The expected start would be FY2008. The ITP is one of the bases for the increase in the plutonium material-at-risk limit from the current 20 kilograms in any room of the Plutonium Facility to 60 kilograms of fuel-grade equivalent plutonium in each of two rooms. This material-at-risk increase would enable LLNL to pursue multiple Stockpile Stewardship Program missions simultaneously. Details of Advanced Materials Program and ITP are presented in Appendix N.

A.2.4.4 *Increased Material-at-Risk Limit for the Plutonium Facility*

The Proposed Action would increase the plutonium material-at-risk limit from 20 to 60 kilograms of fuel-grade equivalent plutonium in each of two rooms of the Plutonium Facility. This increase is needed to meet future Stockpile Stewardship Programs such as the ITP and the casting of plutonium parts. These activities support campaigns for advanced radiography, pit manufacturing, and certification programs.

A.2.4.5 *Increase of Tritium Facility Material Limits*

The Proposed Action would increase the Building 331 Tritium Facility tritium administrative limit from 30 to 35 grams and the material at risk at a single workstation from 3.5 to 30 grams. These increases are needed to support future planned Stockpile Stewardship Program activities such as the high-energy density physics target fill and the Test Readiness Program. The activities support the campaign for inertial confinement fusion and high yield and the readiness to resume testing, if directed.

A.2.4.6 *National Ignition Facility Neutron Spectrometer*

A neutron spectrometer would be constructed and operated as part of the NIF core facility diagnostics capability. The neutron spectrometer would provide a sensitive and accurate measure of the neutrons generated in experiments. The construction would not start before FY2008 and when completed, the neutron spectrometer would become part of the NIF operational facility. The neutron spectrometer would be installed in a specially constructed concrete shaft from the target chamber to a point 52 feet below the surface. The neutron spectrometer would reside at the end of the shaft and contain solid plastic scintillation sheets layered between sheets of lead, with a total mass of approximately 20 tons.

A.2.4.7 *Materials Science Modernization Project*

The Materials Science Modernization Project would provide LLNL with modern infrastructure in the areas of materials fabrication, characterization, and testing relevant to LLNL's national security mission. The 60,000-square-foot facility would be engineered to conduct precision experiments and precision fabrication of designer materials to a level not currently available. The goal is for the Materials Science Modernization Project to serve as a center of excellence for materials research.

A.2.4.8 *Chemical and Biological Nonproliferation Program Expansion*

NNSA proposes to perform research and development activities to develop a variety of biodetector technologies in Building 132S, the NAI/Physics Facility and Building 153, the Microfabrication Laboratory at the Livermore Site. Two classes of detectors would require DNA sequences or antibodies to identify and characterize biological pathogens. Planned activities would include fluid manipulation experiments using LLNL equipment for optical or flow cytometer analysis. This activity would be performed no sooner than FY2005.

Other experiments would evaluate the performance of an electrophoresis detection system for applications involving trace detection of biological warfare agents and precursors. Lasers and an ultra-violet-visible-near-infrared spectrometer would also be used in the laboratories.

A.2.4.9 *Petawatt Laser Prototype*

The proposed petawatt laser prototype would be installed and operation would begin no earlier than FY2005. The petawatt laser is a short-pulse, high-power laser that can be generated by modifying existing solid-state glass laser technology developed at LLNL and other laboratories. The first petawatt laser prototype was demonstrated in Building 391, the Inertial Confinement Fusion Laser Facility and then dismantled when the NOVA laser facility was shut down. To continue this area of research, a second petawatt prototype is proposed for installation and operation in Building 381, the Laser Facility.

A.2.4.10 *Consolidated Security Facility*

The proposed Consolidated Security Facility project would involve the physical consolidation of security services to improve functionality, efficiency, and effectiveness. The scope of work would include the construction of a multipurpose security structure of approximately 50,000 square feet. The facility would contain offices, vaults, conference and meeting rooms, interview rooms, shops, and specialized technical support areas. The new facility would be collocated with the existing Security Department Administration Facility, Building 274.

A.2.4.11 *Waste Management*

Under the Proposed Action, waste management activities would change to accommodate increased waste generation and to improve overall operational methods. These changes would include modifications to permit status for existing facilities to allow different types of waste to be stored or treated; e.g., obtain hazardous waste facility permits for areas now used for nonhazardous or radioactive waste management, and to improve operational flexibility and efficiencies; e.g., raise storage limits and relocate permitted waste treatment units from old facilities to newer facilities.

A.2.4.12 *Building 625 Waste Storage*

The amount of transuranic waste stored in Building 625 radiological and hazardous waste storage facility would be increased to consolidate waste from LLNL facilities planned for decontamination and decommissioning and to accept drums from facilities prior to shipment to the Waste Isolation Pilot Plant (WIPP). The maximum curie limit under the Proposed Action would be equivalent to an array of drums where one drum contains 60 plutonium-equivalent curies and the other surrounding drums contain 12 plutonium-equivalent curies.

A.2.4.13 *Direct Shipment of Transuranic Wastes from the Superblock*

NNSA is proposing to develop the capability to load transuranic waste into pipe overpacks in the Superblock, beginning in FY2005. These pipe overpacks allow for significantly higher actinide loading into each drum for disposal at the WIPP. The pipe overpack is allowed to have up to 80 plutonium-equivalent curies per drum and up to 200 fissile-gram equivalents. The pipe overpack provides a way for LLNL to dispose of waste, such as plutonium with high americium levels. The pipe overpack can be loaded, stored, loaded into TRUPACT-II shipping containers, and shipped from Superblock to the WIPP without increasing the nuclear material inventory or hazard levels in other LLNL facilities. The TRUPACT-II shipping containers would be loaded to the limits of the Waste Isolation Pilot Plant waste acceptance criteria.

A.2.4.14 *Berkeley Waste Drums*

DOE/NNSA is proposing that LLNL accept up to 14 drums of low activity transuranic and mixed transuranic waste from Lawrence Berkeley National Laboratory (LBNL). All liquids would be solidified and corrosive mixed transuranic waste would be neutralized before shipment to LLNL. DOE would use mobile vendors to certify the waste for shipment to the WIPP. This one-time shipment is proposed in order to remove legacy waste from LBNL without creating a WIPP-certified packaging operation at LBNL. The waste would then be shipped directly to the WIPP in a single TRUPACT-II container.

A.2.4.15 *Building Utilities Upgrades*

Within the next 10 years, many of LLNL's key facilities will be past their expected life, severely outdated, and code deficient. The building utilities upgrade project would provide state-of-the-art technological upgrades and reduce maintenance backlog items to selected mission-critical laboratory and office buildings at the Livermore Site. Examples of technological upgrades include expanding building network capability for computing environments; rewiring facilities for high speed networking; replacing secondary electrical distribution system components such as transformers, panelboards, wiring, lighting systems, and power conditioning equipment for sensitive computing and instrumentation equipment; and increasing capacities of mechanical systems to handle increased cooling requirements for computing and laboratory environments (DOE 2003b).

A.2.4.16 *Building Seismic Upgrades*

Executive Order 12941, "Seismic Safety of Existing Federally Owned or Leased Buildings," (EO 12941) requires that all federally owned and leased buildings that do not meet current seismic design and construction standards should be identified and mitigated if necessary. There were 108 buildings identified at LLNL as having potential seismic deficiencies relative to current codes. The deficiencies of these buildings have been prioritized based on a scoring approach that incorporated building vulnerability, failure consequence, and mission-essential factors. This project includes the design and installation of seismic upgrades needed to bring these 108 buildings into compliance with the applicable seismic design and construction standards (DOE 2003b).

A.2.4.17 *Building 696R Mixed Waste Permit*

The purpose and scope of the Part B permit modification needed for Building 696R is to create a new permitted hazardous and mixed waste storage and treatment facility in a section of Building 696R to replace existing capacity and operations. This project would involve the activities specified below and any others necessary as directed by the California Department of Toxic Substances Control.

- Permit a 3,000-cubic-foot liquid storage capacity at Building 696
- Reduce the solid storage capacity in Area 612-5 to 23,900 cubic feet
- Move a 600-ton-per-year drum/container crusher from Area 612 to Building 696. Inform the Department of Toxic Substances Control of a second 600-ton-per-year drum/container crusher to be placed in the same area for managing radioactive waste only.
- Move a 250-ton-per-year size reduction unit from Area 612 to Building 696
- Partially close or delay closure of size reduction unit and drum/container crusher areas at Area 612.

See Appendix B for additional information.

A.2.4.18 *Deactivation, Decommissioning, and Demolition Projects*

Under the Proposed Action, LLNL would D&D 155 excess facilities at the Livermore Site encompassing approximately 691,000 gross square feet of floorspace, including 234,443 square feet under the No Action Alternative. Facility deactivation may include disposition of stored or surplus materials that may be potentially contaminated. These materials and equipment are designated as legacy items, meaning there is no identified sponsor or program. Most legacy materials are materials that were placed in storage or set aside for a future need that never materialized.

Deactivation support activities may include material abatement, characterization, spot decontamination, material containment, spill cleanup, waste packaging, and disposal. Buildings that are obsolete and too expensive to rehabilitate will undergo demolition. The demolition effort would include electrical and mechanical isolation from the LLNL utility grid, sampling for contamination, characterization and proper disposal of all subsystems and components, and dismantling and disposal of the structure. Where feasible, building materials that could be recovered may be segregated and transported offsite for recycling.

The list of excess facilities, including gross square footage and estimated waste generation, is provided in Table A.2.3–2.

A.2.4.19 *Projected Increase in Worker Population*

The NNSA Oakland office is relocating its offices to the Livermore Site. This office relocation is expected to increase the Livermore Site population by about 50 NNSA employees. LLNL expects to add approximately 800 LLNL employees under the Proposed Action above current employment levels.

A.2.4.20 *Increased Administrative Limit for Highly Enriched Uranium for Building 239*

Building 239, Radiography Facility, contains equipment for performing nondestructive evaluation facilities. Facility operations involving radiography are carried out in the basement of the building. The Proposed Action would increase the Building 239 HEU administrative limit from 25 to 50 kilograms to support Stockpile Stewardship Program activities. The use of 50 kilograms of HEU is analyzed in Appendix D and is bounded by the consequences of an accident involving the use of plutonium in Building 239.

A.2.5 Reduced Operation Alternative, Livermore Site

The Reduced Operation Alternative is broadly defined as approximately a 30 percent scaledown from the Stockpile Stewardship Program operations under the No Action Alternative. The following operations reductions would occur under the Reduced Operation Alternative. These initiatives are summarized in Table A.2.3–1 and are considered to be changes to the baseline operations described under the No Action Alternative.

A.2.5.1 *Integrated Technology Project*

The Advanced Materials Program demonstration activities would be discontinued and the Integrated Technology Project would not be implemented. No laser separation of isotopes of surrogate material or plutonium would take place. The Plutonium Facility Engineering Demonstration System equipment would remain in its current status of cold standby. However, this Reduced Operation Alternative project would not meet the full stockpile stewardship mission.

A.2.5.2 *National Ignition Facility Operations Reduction*

Under the Reduced Operation Alternative, the NIF would reduce the annual yield by approximately 30 percent from 1,200 megajoules to 800 megajoules and reduce the tritium throughput from 0.175 grams per year to 0.15 grams per year. The individual experiment yields would remain at up to 20 megajoules (45 megajoules maximum credible yield), but the total number of experiments with high yield would be reduced. These changes would reduce specific environmental impacts such as low-level waste generation, but would not meet the full NIF stockpile stewardship mission. However, by maintaining the full operations and support facilities staff, the facility would be in complete operational readiness, and could be ramped back to full operations if NNSA so directed. Under the Reduced Operation Alternative, the capability to perform tests with either indirect drive or direct drive, after reconfiguration of laser beams and final optics assemblies, would exist.

A.2.5.3 *Reduce Number of Engineering Demonstration Units*

LLNL fabricates engineering demonstration units to demonstrate the acceptability of different nuclear weapon pit technologies for several weapons systems in the U.S. stockpile. Under the Reduced Operation Alternative, NNSA proposes to only fabricate engineering demonstration units for half of the pits in the U.S. stockpile. Engineering demonstration units are used to recapture the technology needed to manufacture pits of various types and to develop and demonstrate pit fabrication processes. These changes would reduce specific environmental impacts such as transuranic waste generation and worker dose. However, this reduction in the number of engineering demonstration units would not meet the full stockpile stewardship mission (LLNL 2002bf).

A.2.5.4 *Reduce Pit Surveillance Efforts*

LLNL performs surveillance activities for all pits in the active and inactive U.S. stockpiles. Pit surveillance activities include determination of the important pit characteristics and destructive examination of the pits to assess suitability for safety and performance. Under the Reduced Operation Alternative, NNSA proposes to perform pit surveillance activities on LLNL-designed pits only, a reduction of 50 percent from the No Action Alternative. These changes would reduce specific environmental impacts such as transuranic waste generation and worker dose. The reduction in pit surveillance activities, however, would not meet the full stockpile stewardship mission (LLNL 2002bf).

A.2.5.5 *Reduce the Number of Subcritical Assemblies*

LLNL fabricates subcritical assemblies for the U.S. Stockpile Stewardship Program. Under the Reduced Operation Alternative, NNSA proposes to fabricate subcritical assemblies for the LLNL testing program only. This nearly 50-percent reduction in operations would reduce specific environmental impacts such as transuranic waste generation and worker dose. However, the reduction would not meet the full stockpile stewardship mission (LLNL 2002bf).

A.2.5.6 *Terascale Simulation Facility Operations Reduction*

Under the Reduced Operation Alternative, NNSA proposes to operate Terascale Simulation Facility at 60 percent capacity (e.g., 60 teraflops). These changes would reduce energy requirements for the facility from 25 megawatts to 15.3 megawatts, but would not meet the full stockpile stewardship mission. However, by maintaining the facility in full operational readiness in terms of hardware, software, and operations staff, the facility could be ramped back to full capacity in a very short time. Therefore, the Reduced Operation Alternative for the facility would include no reduction in staff.

A.3 SITE 300

Site 300 occupies approximately 7,000 acres, approximately 11 square miles, in Alameda and San Joaquin counties, approximately 15 miles southeast of the Livermore Site. Site 300 was established in 1955 as a remote explosives testing ground for the theoretical weapons developed at LLNL. Site 300 facilities offer approximately 381,000 gross square feet of operational space, with 4 percent in temporary facilities. The area surrounding Site 300 is sparsely settled and is used for sheep and cattle ranching, wind farming, and off-road vehicle recreation at the Carnegie State Vehicular Recreation Area. Fireworks America Corporation and SRI International maintain explosives test facilities in the area (LLNL 2002l). The Tracy Hills Development, a planned mix of residential, schools, offices, commercial, industrial, and public service was approved by Tracy City Council in 1998. The development would be located northeast of and adjacent to the test site. Residential development was limited within the city of Tracy by the passage of Measure A, a slow-growth ordinance, in 2000. The residential development portion of the Tracy Hills Development cannot begin until 2007. There are no similar time constraints for the commercial/industrial portion of the development plan, although individual project permits would still require approval by the city of Tracy (Newcorn 2003).

Activities at Site 300 include (LLNL 2002l):

- Test firing of explosives that allows sophisticated diagnostic recovery of high explosives test data
- Dynamic and thermal testing of explosives
- Explosives formulation, processing, machining, radiography, and assembly
- Nonexplosives experimentation
- Testing of weapons components
- Explosives waste treatment
- State-of-the-art destructive and nondestructive materials and weapons design
- Diagnosis of the chemical reactions involved in explosives detonations
- Compatibility and reaction studies of explosives
- Storage of explosives
- Transportation of explosives

Site 300 includes two remote test areas (thermal and dynamic test areas); a chemistry area, process area, a pistol range area, and a general services area (Figure A.3–1 and Figure A.3–2).

A.3.1 Existing Infrastructure

Site 300 infrastructure includes telephones, lighting, other utilities, landscaping, drainage, parking, pathways, and roads. LLNL would continue to maintain, upgrade, and expand this infrastructure under the No Action Alternative, the Proposed Action, and the Reduced Operation Alternative as described in Chapter 3 of this LLNL SWEIS. Figure A.3–1 shows the site map, which illustrates the major roadways. Utilities at Site 300 include domestic water, compressed air, sewage, and electric power. These utilities are described below.

Domestic water is supplied by onsite wells with a current capacity of 930,000 gallons per day. In 2002, the peak usage was approximately 67,900 gallons per day (LLNL 2003aq). A new water supply project has been completed that will supply Site 300 with water from the city of San Francisco's Hetch Hetchy water supply system. The new supply system has an estimated capacity of approximately 648,000 gallons per day with an expansion capacity of 1.2 million gallons per day.

Metered power is supplied by Pacific Gas & Electric Company's Tesla substation. In 2002, the instantaneous electrical load at Site 300 averaged 3.4 megawatts. Site 300 has the capacity to provide up to 20 megawatts (LLNL 2003aq).

Sanitary sewage is piped from the general services area to an oxidation and percolation pond system. In 2002, sewage was pumped at the rate of approximately 2,100 gallons per day. The system has a current capacity of 7,000 gallons per day. Sewage from other areas is disposed of in septic tanks, leachfields, or cesspools at each building (LLNL 2000a).

At the high explosive process area, compressed air is supplied at 125 pounds per square inch from a central air plant at Building 815. Individual air compressors supply the remainder of Site 300's compressed air needs (LLNL 2000a).

A.3.2 Existing Facilities

Facilities at Site 300 are shown in Figure A.3–1 and Figure A.3–2. The following descriptions are limited to facilities with potentially hazardous inventories. Facilities associated with waste management, security, health services, and emergency response are also briefly described.

The selected facilities at Site 300 are described in Sections A.3.2.1 through A.3.2.28 and are listed in Table A.3.2–1, with information on location, square footage, operations, and hazard assessment. Figure A.3.2–1 highlights the selected facilities. Hazards may be radiological, chemical, or other. Radiological hazards include low-level ionizing radiation, which could cause cancer, genetic defects, or noninheritable birth defects. Chemical hazards include chemicals that may be toxic, flammable, corrosive, poisonous, and/or carcinogenic. Other hazards include high explosives, non-ionizing radiation, biological agents, compressed gas cylinders, and electrical equipment. A brief summary discussion on generated wastes and effluents is included. For a more detailed discussion on waste generation and waste management, refer to Appendix B.

An overview of all facilities is included in Table A.3.2–2. Several facilities at Site 300 that were described in the 1992 LLNL EIS/EIR (LLNL 1992a) have been excessed. Excessed refers to a facility, materials, etc. that are no longer necessary to meet a program's mission and are being returned to LLNL's Director of Operations for future use.

A.3.2.1 *Building 801 Complex*

The Building 801 Complex comprises Buildings 801A, 801B, and 801D and is approximately 51,000 gross square feet. The Building 801 Complex is part of the explosives test facilities and is in the northeast quadrant of the site, called the east firing area (LLNL 2001ao).

An indoor firing chamber was added as part of the contained firing facility modifications made between 1998 and 2001. Performing test explosions in the firing chamber dramatically reduces particle emissions and minimizes the generation of hazardous waste, noise, and blast pressure (LLNL 2002cl). The modifications also included a new support facility, mechanical/electrical equipment area, and a diagnostics equipment facility in Building 801A. Additional office facilities were added to Building 801D (LLNL 2001ao).

The Building 801 Complex is designed to obtain explosives test data through the use of the flash x-ray accelerator, designed to accelerate charged particles and generate x-rays; a high-speed camera; and a laser-doppler interferometry operation. This equipment measures the velocity of explosively driven surfaces. Other electronic and mechanical systems capable of diagnosing various aspects of the high explosives tests are housed in Building 801 Complex facilities (LLNL 2001ao).

Hazards Assessment

The common hazards at this firing complex are associated with the handling and firing of explosives, high voltage electricity, toxic and radioactive materials, high levels of ionizing radiation, lasers, cranes and machine tools, and high-pressure systems. Personnel could be exposed to x-rays from the flash x-ray accelerator or non-ionizing radiation from high-power lasers. The high-speed rotor cameras, if allowed to revolve at too high a speed, will come apart, scattering parts of the beryllium rotor around the camera room.

The hazards in the photoprocessing operations are various laboratory reagents, photochemicals, and chemicals in spent developers, fixers, and rinsewaters. When film is processed, the developers and fixers are automatically replenished and waste is captured in separate barrels.

Formal operational safety procedures have been prepared for the facility as a whole. These are supplemented for individual tests. Procedures are reviewed by the Hazards Control Department. All explosives are handled, transported, and test fired following these procedures. All work with radioactive materials and toxic materials conforms to established health and safety guidelines.

In the explosive firing facilities, personnel safety is enhanced by positive key control of the various aspects of the operation, including enabling the firing console. Personnel are excluded from areas of x-ray flux by fences, barriers, and interlocked access doors and gates. The interferometer room is also interlocked. Equipment is electrically isolated from the shot assembly until personnel are under cover. A muster or positive accounting is used for control of personnel access to the test area.

Personnel are not allowed to enter the firing chamber after a shot until specific conditions are met, including waiting for a specified period of time in case of malfunction or misfire. Re-entry into the firing chamber is performed after the chamber ventilation has purged hazardous atmospheres. Personnel use personal protective equipment that is appropriate to the exposure potential of the hazardous materials in the chamber (LLNL 2001ao).

Generated Wastes and Effluents

The containment chamber is equipped with a portable, manually operated water washdown system that uses an articulating nozzle. This system washes detonation residue that may contain radioactive materials, such as depleted uranium, or hazardous contaminants, such as beryllium, from the firing chamber walls and floor. A manually operated hose and a high-pressure washer are also used, when necessary, to complete the cleanup process. The washdown water from the chamber is diverted to a 20,000-gallon holding tank, filtered, and reused. However, if it becomes necessary to dispose of the washdown water stored in the holding tank, the water would be sampled and transferred to the Livermore Site for discharge to the sanitary sewer if parameters are within acceptable limits. If not, the water would be transferred to RHWM for appropriate disposal. Other wastewater, including photographic wastewater and water generated from a protective clothing washing process, would be handled in a similar manner that could include transferring the water to the Site 300 Class II surface impoundments (LLNL 2001ao).

Tritium has contaminated the firing chambers in the past and will be a contaminant in the future. The hazardous wastes generated from the photoprocessing operations, the flash x-ray, and the interferometry operations include solvents, lubricating fluids, dielectric fluids, and photographic wastes. These nonradioactive wastes are temporarily stored in the workplace waste accumulation area and transferred to RHWM for treatment and/or disposal (LLNL 2001ao).

A.3.2.2 *Building 804*

Building 804 is a 3,733-gross-square-foot facility in the northeast quadrant of Site 300. This facility is currently used exclusively as the staging area for low-level radioactive wastes generated in any of the Site 300 facilities before the wastes are shipped to a proper disposal site. A small bunker at this facility is currently not being used but may be used in the future (LLNL 2001ao).

Low-level radioactive wastes are generated at bunker firing tables where test assemblies are detonated. The waste debris consists of gravel, wood, steel, aluminum, concrete, plastic, glass, burlap bags, cables, and other inert testing materials. RHWM prepares the containerized gravel at Building 804 for offsite disposal (LLNL 2001ao).

Other specific waste streams handled at Building 804 include empty containers, contaminated paper and rags, protective clothing, glassware, plasticware, tubing and fittings, wood and metal parts, HEPA filters contaminated with radioactive constituents, nonhazardous residues, metals, and contaminated equipment.

Hazard Assessment

Wastes stored at this facility consist primarily of low-level radioactive wastes. The low-level radioactive wastes consist of depleted uranium and, on rare occasions, small amounts of thorium. Mixed wastes also contain metal components (LLNL 2001ao).

Proper segregation and control of the packaging and handling operations are essential for the safety of personnel and protection of equipment. Operational safety features include characterizing firing table waste to segregate low-level radioactive waste from mixed waste; specifying containers for shipment and disposal or reprocessing of low-level radioactive wastes at an offsite location; following procedures for sampling and analysis, containerization, staging, and certification of wastes; fulfilling record keeping requirements; and conducting radiation measurements. The external radiation measurements for shipping or disposal containers are included on the computerized record keeping system and are also noted on each container (LLNL 2001ao).

Generated Wastes and Effluents

This facility is used primarily as a staging area for low-level radioactive wastes before reconditioning or shipment to an offsite disposal location. No wastes are generated at Building 804 (LLNL 2001ao).

A.3.2.3 *Building 805*

Building 805 is a 6,802-square-foot facility in the southeast quadrant of Site 300, known as the process area. Building 805 is used for machining metal and nonmetal parts; i.e., stainless steel, brass, plastic, etc., and mock explosives. The packaging or repackaging of explosives waste is also performed at this facility prior to storage at the Explosives Waste Storage Facility (EWSF) or shipment to the Explosives Waste Treatment Facility (EWTF) for treatment (LLNL 2002ap).

Hazards Assessment

The major hazard associated with packaging and repackaging waste explosives is the possibility of detonation of the explosives by mishandling. The hazards associated with the machining process involve rotating equipment and toxic chemicals in the explosives waste and mock explosives (LLNL 2002ap).

Generated Wastes and Effluents

Wastes generated during the machining of mock explosives consist of dust. The nonhazardous dust is collected in a air district permitted dust collector and disposed of in the general trash (LLNL 2002ap).

A.3.2.4 *Building 806 Complex*

The Building 806 Complex is located in the process area in the southeast quadrant of Site 300 and consists of Buildings 806A and 806B. This 8,314-gross-square foot complex is used for machining and inspecting explosive parts. Explosives are also temporarily stored at the complex (LLNL 2002ap).

Hazards Assessment

The major hazard associated with this complex is the detonation of explosives during the machining process. Risks also include those associated with the operation of the machinery and chemicals used in the machining process. Machining is performed both with an operator present and remotely from a control room. During remote operations, all operations personnel are alerted, fences are secured with warning lights and alarm systems, and the limited personnel present are restricted to the control room (LLNL 2002ap).

Generated Wastes and Effluents

Wastes contaminated with high explosives are generated in the Building 806 Complex. The water used during the machining process is passed through two filter bags, and the trapped explosives waste is placed in plastic-lined containers for storage and treatment at the EWTF. The filtered water passes through a conical clarifier, settling basin, and weir and then drains to surface impoundments south of the complex. Scrap explosive pieces are wrapped, boxed, and labeled for treatment at the EWTF and storage at the EWSF (LLNL 2002ap).

A.3.2.5 *Building 807*

Building 807 is located in the process area in the southeast quadrant of Site 300 and is used for activities similar to those of the Building 806 Complex. This 1,575-gross-square-foot facility is used to machine and inspect explosives parts and to decontaminate potentially contaminated equipment. Explosives parts are also temporarily stored at the complex (LLNL 2002ap).

Hazards Assessment

The major hazard associated with this building is the detonation of the explosives during the machining process. Risks also include those from the rotation of the machinery and chemicals used in the machining process. Machining is performed both with an operator present and remotely from a control room. During remote operations, all operations personnel are alerted, fences are secured with warning lights and alarm systems, and the limited personnel present are restricted to the control room (LLNL 2002ap).

Generated Wastes and Effluents

Wastes contaminated with high explosives are generated in Building 807. The water used during the machining process is passed through two filter bags, and the trapped explosives waste is placed in plastic-lined containers for storage and treatment at the EWTF. The filtered water passes through a conical clarifier, settling basin, and weir and then drains to surface impoundments south of the complex. Scrap explosive pieces are wrapped, boxed, and labeled for treatment at EWTF and storage at the EWSF (LLNL 2002ap).

A.3.2.6 *Building 809 Complex*

The Building 809 Complex is located in the process area in the southeast portion of Site 300. This 3,005-gross-square-foot complex consists of Buildings 809A, 809B, and 809C. Building 809A is currently being modified to install an isostatic press for pressing explosives powders into parts. Building 809B is under construction as a utilities service building. Building 809C is under construction and will house ovens for preheating explosives powders prior to pressing. A new magazine has also been constructed at this complex (LLNL 2002ap).

Hazards Assessment

The major hazard associated with machining explosives is the possibility of ignition from the forces involved. There are also hazards associated with high temperatures and pressures and the toxic nature of the chemicals in the explosives that present the risk of injury to personnel. Rotating equipment also presents the risk of injury to personnel. Heating and pressing of explosives are conducted remotely, under controlled temperature conditions (LLNL 2002ap).

Operational safety plans are enforced in the Building 809 Complex to ensure personnel safety. During remote operations, all personnel and the process security post operator are alerted, the gate to the area is locked warning lights and alarm systems are activated and the limited personnel present are restricted to the control room (LLNL 2002ap).

Generated Wastes and Effluents

Currently, there are no explosives-contaminated wastes generated at this building complex, but in the future, there will be wastes that will be handled following the process described for Building 817 (LLNL 2002ap).

A.3.2.7 *Building 810 Complex*

The 5,079-gross-square-foot Building 810 Complex is located in the process area, in the southeast quadrant of Site 300, and consists of Buildings 810A, 810B, and 810C. Building 810A and 810B are used to assemble explosives parts into test components. Building 810A is also used for the temporary storage of explosives parts. Building 810C is used for storing nonexplosive parts for test components. The test components may also include beryllium, lithium, tritium, thorium, or depleted uranium (LLNL 2002ap).

Hazards Assessment

The major hazard associated with this complex is the detonation of the explosives by dropping or mishandling. The number of personnel is limited in these buildings (LLNL 2002ap).

Generated Wastes and Effluents

High explosives-contaminated wastes are generated at this complex. Explosives waste is placed in plastic-lined containers for treatment at the EWTF and storage at the EWSF (LLNL 2002ap).

A.3.2.8 *Building 812 Complex*

The Building 812 Complex is an active open-air explosives firing facility. The complex includes five buildings (Buildings 812A, 812B, and 812C, 812D [currently inactive], and 812E), two magazines, and an open-air firing table. Building 812E is currently used to repair and test portable x-ray equipment. The current complex total operational building area is 5,532 gross square feet (LLNL 2001ao).

Hazards Assessment

The common hazards associated with the Building 812 firing facility are handling and firing explosives, high-voltage electrical equipment, toxic and radioactive materials, high levels of ionizing radiation, operational and maintenance equipment, and high-pressure systems. There may be exposure to ionizing radiation from portable radiation generating devices (LLNL 2001ao).

The hazards in the photoprocessing operations are various laboratory reagents, photochemicals, and chemicals in spent developers, fixers, and rinsewaters. When film is processed, the developers and fixers are automatically replenished and the generated waste is captured in separate barrels (LLNL 2001ao).

Formal operational safety procedures have been prepared for the facility and these are supplemented for the peculiarities of individual tests and reviewed by the Hazards Control Department. All explosives are handled, transported, and test fired only while strictly following these procedures. All work with radioactive toxic materials conforms to established health and safety guidelines. Additional restrictions are imposed during the grass fire season (LLNL 2001ao).

Personnel safety is enhanced by positive key control in the explosive firing facilities. Personnel are excluded from areas of x-ray flux by fences, barriers, and/or interlocked access doors and gates. Equipment is electrically isolated from the shot assembly until personnel are under cover. A muster is used for positive control of personnel access to the test area (LLNL 2001ao).

Personnel are not allowed to enter the firing table area after a shot until specific conditions are met, including waiting for a specified period of time in case of malfunction or misfire. Appropriate personal protective equipment is used to re-enter the firing table after experiments involving hazardous materials. Water may be used to put out fires on the table and minimize dust production.

Generated Wastes and Effluents

Debris may consist of gravel, wood, steel, aluminum, concrete, plastic, glass, burlap bags, cables, and other inert testing materials. These wastes may be contaminated with depleted uranium or thorium. Small amounts of metals; e.g., lead, beryllium, copper, barium, vanadium, etc., may also be present (LLNL 2001ao). In the past, tritium was a contaminant at this facility, but tritium experiments will be discontinued at this facility in the future (LLNL 2003i). The detonation debris is characterized to segregate the low-level radioactive waste from hazardous waste. The low-level radioactive waste is placed in containers for recycling or transported to the Building 804 waste staging area. All hazardous wastes are transported to Building 883 for storage prior to transfer to Livermore Site or shipment offsite for disposal (LLNL 2001ao).

The hazardous wastes generated from the photoprocessing operations and the portable x-ray operations include solvents, lubricating fluids, dielectric fluids, and photographic wastes. These nonradioactive wastes are temporarily stored in the workplace waste accumulation area until transferred by RHWM for treatment or offsite disposal (LLNL 2001ao).

A.3.2.9 *Building 817 Complex*

The High Explosives Pressing and Oven Complex, the Building 817 Complex, is located in the southeast quadrant of Site 300. This 2,739-square-foot complex comprises Buildings 817A through 817H and includes laboratories, mechanical equipment areas, a control room, and storage space for the preparation and isostatic pressing of bulk explosives and mock high explosives (LLNL 2002ap).

Building 817A is a control room, Building 817B is the high explosives pressing facility, Building 817C is a temporary storage magazine, and Buildings 817D and 817E are currently inactive, but may become active if needed. Building 817F is the oven facility used for heating and annealing explosives. The oven facility contains two ovens, a scrub water tank and pump unit, an insulated transport cart, and handling trays. Building 817G is the boiler room facility and Building 817H is used for storage of inert parts, pressing bags, and general chemicals (LLNL 2002ap).

Hazards Assessment

The major hazard at this complex is an inadvertent explosion as the result of the handling, heating, and pressing of explosives. There is also the risk of injury to personnel associated with high temperatures and pressures or the toxic chemicals in the explosives. Heating and pressing of explosives are conducted remotely, under controlled temperature conditions. During remote operations, all personnel are alerted, the fenced area is locked, and warning lights and alarm systems are activated. Operating personnel are limited in number and restricted to the control room during remote operations. Explosives are permitted only in approved and posted areas, and an insulated cart is used to transfer hot material from the oven and from pressing operations. The work areas are frequently washed, and equipment, tools, fixtures, and other parts that may have become contaminated are decontaminated. Safety protocol and procedural documentation are used to ensure personnel safety (LLNL 2002ap).

Generated Wastes and Effluents

Wastes contaminated with high explosives are generated in this complex. Water is used in the cleanup process. The high explosives wastewaters are passed through two filter bags, and the trapped explosives waste are placed in plastic-lined containers for treatment at the EWTF and storage at the EWSF. The filtered water passes through a conical clarifier, settling basin, and weir and then drains into a retention tank that pumps automatically to the surface impoundment south of the complex. The scrap explosive pieces are wrapped, boxed, and labeled for treatment at the EWTF and storage at the EWSF (LLNL 2002ap). Other wastes include explosive-contaminated debris such as paper, protective clothing, and laboratory equipment and cleaning solutions.

A.3.2.10 *Building 819*

The Decontamination Facility, Building 819, is located in the southeast quadrant of Site 300. This 811-square-foot facility is used for pesticide mixing and storage, construction material storage, and equipment (vacuum pump) repair. Pesticides are mixed in a small room measuring 6 feet square. Pesticide containers are steam cleaned beneath a canopy adjacent to the facility.

Rinsewaters are collected and stored in tanks prior to treatment and/or disposal by RHWM (LLNL 2002co).

Hazards Assessment

The pesticide chemicals are toxic and care must be taken to prevent uptake by personnel. Operational safety procedures provide that the Hazards Control Department surveys the work area regularly to detect unsafe conditions, personnel wear pesticide cartridge respirators and natural rubber gloves when working with pesticides and take a shower after the work is completed, personnel wear organic vapor respirators and rubber gloves when working with solvents, the pesticides are stored in locked areas, and empty pesticide containers are disposed of properly (LLNL 2002co).

Generated Wastes and Effluents

The rinsewaters from cleaning pesticide containers are stored in tanks and cannot be discharged into the Building 819 drainage system. The tanks are handled by RHWM for proper treatment and disposal. The empty pesticide containers are rinsed thoroughly and inspected by the San Joaquin County Agricultural Commission before disposal at a local municipal landfill. The wastewater generated from the steam-cleaning operations is stored in a retention tank. When the tank is full, its contents are sampled and analyzed. Wastewater is then transferred by RHWM for treatment or disposal (LLNL 2002co).

A.3.2.11 *Building 821*

Building 821 is a 454-square-foot building in the southeast quadrant of Site 300 where flammable liquids are stored for use in the chemistry area (LLNL 2002ap).

Hazards Assessment

The major hazards are exposure to toxic effects of flammable material through inhalation of vapors and absorption by skin contact or ingestion (LLNL 2002ap).

Generated Wastes and Effluents

No waste is generated at Building 821 (LLNL 2002ap).

A.3.2.12 *Building 822*

The Building 822 storage facility is in the southeast quadrant of Site 300. This 296-square-foot building consists of four storage cells (A, B, C, and D) that are used to store nonexplosive controlled materials such as radioactive materials (solid depleted uranium, solid thorium, and tritium), deuterium, lithium hydride, sealed sources (Class 1 and 2 only), mock explosives, and solid beryllium. Explosives and other hazardous materials are not permitted in the building (LLNL 2000u).

Hazards Assessment

Safety features within this building include alarms and warning signs. The cell doors are secured by combination locks and have alarms. Access to the cells is limited to authorized personnel. Even though there are no adverse exposure consequences to onsite workers from normal operations, site personnel may receive exposures from radioactive materials, including sealed sources and depleted uranium, due to container ruptures during transfer operations. Materials are packaged to meet DOT requirements for transportation and would offer no adverse exposure risks unless the containers are breeched (LLNL 2002l, LLNL 2000u).

Generated Wastes and Effluents

This facility is used primarily for the storage of controlled materials; therefore, no wastes are generated (LLNL 2002l).

A.3.2.13 *Building 823 Complex*

The 2,748-square-foot LINAC Radiography Complex, Building 823, is in the southeast quadrant of Site 300 and consists of two buildings. Building 823A contains office space, a darkroom with a radiographic film processor, and control panels for three real-time imaging systems housed in Building 823B. These units include a transportable 9-million-electron-volt, a 2-million-electron-volt, and 120-thousand-electron-volt x-ray machines. Building 823B contains staging and real-time imaging systems, and a doubly encapsulated cobalt-63 isotope source in a lead-shielded radiographic projector. The isotope source is no longer operational and is being stored in Building 823 in a transportainer until it is sent back to the manufacturer for disposal. This complex provides the means for radiographic inspection of pressed explosives parts and weapon test components. After x-ray film has been exposed in Building 823B, it is processed through the automatic film processor in Building 823A. The authorized materials in this facility include explosives, natural and depleted uranium, and beryllium in metallic form. Fissile materials currently are not allowed at Site 300 but may be allowed only after thorough review and approval by Site 300 management and after proper operational safety procedures are applied (LLNL 2002ap).

Building 823B has an earth berm on two sides that provides radiation shielding for the office/control building located east of the berm. The Varian 9-million-electron-volt LINAC is used in Building 823B to beam into the open space directly to the west (LLNL 2002ap).

Hazards Assessment

The potential hazards in the Building 823 Complex arise primarily from the intense levels of radiation associated with the generated x-ray beam, the high voltages associated with the power supplies, and the handling of test units containing explosives, radioactive, or toxic materials. Explosives in powder form are not permitted at this facility, and explosives are not permitted at the facility when fissile materials are present. The number of personnel is limited to five when explosives are present. Protection from inadvertent exposure to x-radiation is provided by physical barriers, warning lights and chimes, safety interlocks, signs, and remote area monitoring. Before starting an x-ray operation, all personnel evacuate the fenced enclosures. A remote area monitor in the complex, which indicates radiation levels on a local readout meter and on a duplicate meter in the control room, activates the warning lights and chimes when radiation levels become high. Flashing magenta lights and pulsed chimes indicate an x-ray exposure is in progress. No one is allowed to enter the area at that time. The operating area is enclosed by a safety fence and all gates are locked during operation of the machine (LLNL 2002ap).

Generated Wastes and Effluents

The wastes generated from this facility include photochemicals, spent fixers and developer, and photochemical rinsewaters. The photochemical rinsewaters are stored in retention tanks and pumped to the surface impoundment. The spent fixers and developers are handled by the materials management group and taken to the Livermore Site for silver recovery (LLNL 2002ap).

A.3.2.14 *Buildings 825, 826, and Building 827 Complex*

The Chemistry Area Complex comprises Buildings 825 and 826 and the Building 827 Complex and is used for processing, developing, and testing explosives. Buildings 825 and 826 are in the southeast quadrant of Site 300 and have areas of 1,224 square feet and 1,742 square feet, respectively. The Building 827 Complex, consisting of Buildings 827A, B, C, D, and E, with office, laboratory, and storage areas, is located in the south-central section of Site 300 and has a total area of 7,744 square feet (LLNL 2002ap).

Building 825 houses mechanical presses for pressing explosives and a Monel detonation sphere. A vacuum gas sampling system associated with the Monel detonation sphere, which measures detonation products, is currently nonoperational (LLNL 2002ap).

Building 826 houses a vertical temperature-controlled mixer for mixing explosives; binders, plasticizers, and other compounds; and a 2-ton mill for mixing extrudable (paste) explosives. A 50-cubic-inch deaerator loader is used for processing the extrudable explosives (LLNL 2002ap).

The Building 827 Complex consists of Buildings 827A, B, C, D, and E. Building 827A contains offices, a control room and a small-scale explosives cell. Building 827B contains a machine shop and inert storage area. Buildings 827C, D, and E are identical buildings each containing two explosives operating cells, an equipment room, an inert storage area, and a temporary explosives storage vault. The complex also contains three steam ovens for drying materials, small ball mills for reducing particle size, a 50-pound deaerator loader for processing extrudable explosives, blenders, slurry kettles for preparing explosives, and slurry-coating equipment. Equipment includes an environmental chamber and associated control and interlock modules, electrical resistance measurement devices, a gas sampling oven, a laser particle-size analyzer, and a computer system (LLNL 2002ap).

Hazards Assessment

Hazards associated with these facilities include the detonation of explosives powder during the pressing process and exposure to the toxics effects through the inhalation of dusts or vapors and absorption by skin contact or ingestion. Pressing explosives is conducted remotely. During remote operations, all personnel are alerted. Hazards also are associated with handling explosives, propellants, pyrotechnics, and oxidizers and burning or detonating materials through impact, frictional heat, shock, electrical arcs, or sparks from static electricity. Hazards also include those associated with a small, enclosed laser. Mixing and loading of the explosives is conducted actively and remotely depending upon the requirements. The fenced area around the building is locked and warning lights and alarm systems are activated. Operating personnel are restricted to Buildings 827A or 827B. Safety documentation, including operational safety plans and the facility safety plans, is used to help ensure personnel safety (LLNL 2002ap).

Generated Wastes and Effluents

Wastes contaminated with high explosives are generated from activities performed in this complex. The explosives-contaminated trash is placed in plastic-lined containers for treatment at the EWTF and storage at the EWSF. Typical wastes include alkaline and acid solutions such as lab-packed solutions; lab-packed waste chemicals; nonhalogenated organic solutions; empty containers; debris such as contaminated paper and rags, protective clothing, glassware, plasticware, tubing and fittings, wood and metal parts, and HEPA filters contaminated with explosives and other hazardous constituents; wastewater; residues; metals; flammable liquids; cleaning solutions, including solvents; waste oil with trace gasoline, diesel, organics, and metals; and contaminated equipment.

Water used in the cleanup is passed through two bag filters that trap the explosives waste. The waste is placed in plastic-lined containers for treatment at EWTF and storage at the EWSF. The filtered water is collected in a retention tank where it is sampled prior to being trucked to the permitted surface impoundment or offsite (LLNL 2002ap).

A.3.2.15 *Building 816, Explosive Waste Storage Facility*

The EWSF is in the process area in the southeast quadrant of Site 300. The EWSF consists of a main structure (Building 816) and four earth-covered waste storage magazines and comprises approximately 1,200 square feet. The EWSF is permitted under a hazardous permit issued by the California Department of Toxic Substances Control for 1-year storage of explosives waste. Storage of other hazardous, radioactive, or mixed waste materials is prohibited (LLNL 2002ap).

Hazards Assessment

The major hazard associated with storing waste explosives is the possibility of detonation of the explosives through mishandling (LLNL 2002ap).

Generated Wastes and Effluents

The facility is used as a storage facility. No wastes are generated by this facility (LLNL 2002ap).

A.3.2.16 *Building 845, Explosive Waste Treatment Facility*

The EWTF is a 666-square-foot facility located in the north-central section of Site 300. The EWTF replaces Building 829, which has been closed. The EWTF consists of an earth-covered control room, Building 845A; an inert storage area, Building 845B; a thermal treatment unit (burn cage), an open burn unit (burn pad), and an open detonation unit (detonation pad). The EWTF is permitted under a hazardous waste permit issued by the California Department of Toxic Substance Control for the treatment of explosives waste. Treatment of other hazardous, radioactive, or mixed waste materials is prohibited (LLNL 2002ap).

Hazards Assessment

The main hazard associated with treating waste explosives is the possibility of detonation by mishandling. Personnel are limited in number and operations are conducted remotely. During operations, personnel are restricted to the control room, fencing is secured, and warning lights and alarm system are activated appropriately (LLNL 2002ap).

Generated Wastes and Effluents

Ash resulting from the burning of explosives waste in the thermal treatment cage and open burn unit is collected, weighed, and stored in an approved storage area within the facility. The ash is hazardous and is shipped offsite for proper disposal (LLNL 2002ap).

A.3.2.17 *Building 832 Complex*

The Building 832 Complex is in the southeast quadrant of Site 300 and consists of five buildings labeled 832A through 832E, two magazettes labeled M-832-1 and M-832-2, and the explosives vehicle inspection station, for a total gross area of 10,970 square feet. The Building 832 Complex is the central explosives materials shipping and receiving facility for LLNL, and the facility for shipping and receiving other controlled materials at Site 300 (LLNL 2000u).

Buildings 832A through 832C are storage facilities. Inert nonhazardous materials are stored in Buildings 832A and 832C. Building 832B is limited to the interim storage of explosives and explosives assemblies that may contain other controlled materials; i.e., depleted uranium, thorium, tritium, beryllium, lithium, deuterium, and mock explosives. Long-term storage is not allowed in Building 832B (LLNL 2000u).

Building 832D is limited to shipping and receiving of explosives and explosives assemblies that may contain other controlled materials, and sealed sources. Interim storage is permitted in Building 832D to complete shipping and receiving operations (LLNL 2000u).

Building 832E is limited to shipping and receiving of nonexplosive controlled materials, classified parts, sealed sources, and liquid nitrogen. Explosives and other hazardous materials are not permitted in the building. Interim storage is permitted in Building 832E to complete shipping and receiving operations (LLNL 2000u).

The explosives vehicle inspection station is used to inspect incoming commercial explosives transport vehicles prior to entering the Building 832 Complex. Explosives loading, unloading, and transloading are permitted at the explosives vehicle inspection station (LLNL 2000u).

Hazards Assessment

The primary hazards associated with the Building 832 Complex include exposure to explosives; toxic, reactive, pyrophoric, and carcinogenic materials; and ionizing and non-ionizing radiation. Activities within this complex are controlled by facility and operation safety plans. All work with radioactive or toxic materials conforms to established health and safety guidelines. Safety features include alarms and warning signs. The cell doors are secured by combination locks and are alarmed. Access to these facilities is limited to authorized personnel (LLNL 2000u).

Generated Wastes and Effluents

This complex is used primarily for shipping and receiving explosives and other controlled materials. No hazardous wastes or effluents are generated during normal facility operations. The quantity of waste generated is less than one cubic meter per year (LLNL 2000u).

A.3.2.18 *Building 834 Complex*

The Thermal Test Complex, Building 834, is in the southeast quadrant of Site 300 and consists of 12 buildings labeled 834A through 834H and 834J through 834M. The total gross area of these buildings is 8,267 square feet. This complex is used primarily for the thermal testing (cycling, shocking, and soaking) of specimens that may contain explosives or toxic materials and mock high explosives (LLNL 2002j). The use of a portable 9-million electron volts LINAC has been approved for occasional use at this facility.

The complex consists of four test buildings (834E, G, H, and J) three mechanical equipment buildings (834B, C, and D) three storage buildings (834F, K, and L) a storage magazine (834M) and a control building (834A). The test buildings, also known as test cells, are behind large earth berms. The control building and the mechanical equipment buildings are designed to withstand accidental detonation of explosives in the test cells (LLNL 2002j).

The principal operation here is the thermal testing of specimens that may contain explosives, radioactive, and/or toxic materials. During testing, a component is exposed to a given temperature for a specified time. The component may be cycled between cold and hot temperatures for hours or days and may be thermally shocked by introducing hot or cold air over the specimen (LLNL 2002j).

Hazards Assessment

A variety of materials and equipment are tested in this complex. Authorized materials used include high explosives, mock explosives, depleted uranium, thorium, lithium, and beryllium in metallic form (LLNL 2002j).

All operations in the Building 834 Complex are controlled by the facility safety plan (LLNL 2002bt). The plan ensures that explosives and explosives-contaminated materials are permitted only in test cells. No drilling, machining, sawing, or sanding of explosives and no operation requiring blending or mixing of explosives with other materials such as plastics, binders, adhesives, or metal dusts is permitted. Hazards also include those associated with the occasional use of a portable LINAC unit. Safety features in this complex include alarms and warning signs. The cell doors are secured by combination locks and have alarms. Access to these facilities is limited to authorized personnel (LLNL 2002j).

Generated Wastes and Effluents

This complex is used primarily as a test facility, and there are no hazardous wastes generated. Occasionally, scrap and solid waste are left after testing is completed. The quantity of solid waste generated is less than 1 cubic meter per year (LLNL 2002bt).

A.3.2.19 *Building 836 Complex*

The Dynamic Test Complex, Building 836, is in the southeast quadrant and consists of four buildings, 836A through 836D, with a total area of 13,288 square feet. The complex is used for the dynamic (vibration shock) testing of specimens containing explosives, radioactive materials, and/or toxic materials. An electrodynamic shaker can be programmed by computer to perform sine and random vibration and transient pulses. These tests can be performed at various temperatures in a thermal chamber. A portable 9-million-electron-volt LINAC is approved for occasional use at this complex (LLNL 2002bu).

The Dynamic Test Complex consists of a reinforced concrete control building (836A); a steel mechanical equipment and storage building (836B); an earth-covered, reinforced-concrete test cell (836C); and a reinforced-concrete electrodynamic shaker building (836D) (LLNL 2002bu).

Each test cell houses a large reaction mass needed as a counterweight and its associated hardware. This equipment is used in the testing and evaluation of various weapons systems and mechanical equipment subjected to vibration and shock environments. The complex has also been used for shock and vibration testing of rocket motors, seismic qualification of turbine-generator sets, and performance analysis of the rock bolts used in mine-tunnel construction (LLNL 2002bu).

Hazards Assessment

A variety of materials and equipment are tested in this complex. A portable 9-million-electron-volt LINAC is approved for occasional use at this complex. Authorized materials include explosives, mock high explosives, metallic beryllium, depleted uranium, thorium, and lithium hydride (LLNL 2002bu). In the thermal and dynamic tests, there is a possibility of putting sufficient energy into the test to detonate the explosives (LLNL 2002bu).

Personnel and operational safety controls are in effect. Tests with a moderate to high risk of reaction are done remotely. Remote procedures are required for tests involving mechanical shock or extrusion to the explosives and when the temperature of the explosives is above 170 degrees Fahrenheit (^{o}F). These remote operations are controlled from a central control room protected from blast and fragments. During dynamic testing, musters limit the areas that personnel can enter. Continuous air monitoring is used during the test operation (LLNL 2002bu).

Fissile material and explosives are not permitted within a test assembly or within a facility at the same time. Explosives or explosive-contaminated material is permitted only in test cells. No operation is permitted that intentionally generates explosives dust or powder or that requires blending or mixing of explosives with other materials such as plastic, binders, glues, adhesives, or metal dust (LLNL 2002bu).

When a test cell has been flushed with nitrogen during a thermal conditioning test, the air within the facility is monitored prior to allowing personnel to re-enter the facility (LLNL 2002bu).

Generated Wastes and Effluents

This complex is used primarily for dynamic testing of equipment containing hazardous and toxic materials. Typical wastes would include alkaline and acid solutions; lab-packed waste chemicals; nonhalogenated organic solutions; empty containers; debris such as contaminated paper and rags, protective clothing, glassware, plasticware, tubing and fittings, and wood and metal parts; wastewater; residues; metals; cleaning solutions, including solvents; waste oil with trace gasoline, diesel, organics, and metals;, and contaminated equipment. Occasionally, scrap and solid waste is left over when testing is completed. The quantity of this solid waste is less than 1 cubic meter per year (LLNL 2002bu).

A.3.2.20 *Building 850 Complex*

The Hydrodynamics Test Facility, Building 850 Complex, is part of the explosive test facility. This 5,840-gross-square-foot complex consists of Bunker 850 and a magazette in the northwest quadrant of the site (called the west firing area) and comprises an active firing, explosives test, and high-speed camera repair and test facility. The multidiagnostic facility includes a permanently mounted, smooth-bore, 155-millimeter gun for conducting impact experiments, high-speed rotating-mirror cameras, gigalumen light sources, portable flash x-ray sources, and various other diagnostic equipment (LLNL 2001ao).

This facility has an outdoor detonation firing table with gravel covered pads for stands of concrete, wood, or steel. During an experiment, the explosive is placed on the test stand and fired. The firing debris may consist of wood, plastic, wiring, and gravel. This debris is potentially contaminated with high explosives, beryllium, and depleted uranium (LLNL 2001ao).

Hazards Assessment

The common hazards associated with the firing facilities are those associated with the handling and firing of explosives, high-voltage equipment, toxic and radioactive materials, cranes and machine tools, high-pressure systems, and high levels of ionizing radiation. Potential hazards include firing malfunctions, misfires, and grass fires (LLNL 2001ao).

The hazard associated with the high-speed photographic equipment is use of high-speed rotors. Some camera rotors are made of beryllium; if these rotors are allowed to revolve at too high a speed, they will come apart, causing damage and scattering parts of the beryllium rotor around the camera room (LLNL 2001ao).

HEPA filtration systems in the intake of the open-air bunker ventilation system mitigate any hazardous material released into the facility environment. The risk of an inadvertent firing of a propellant-driven gun or an improper projectile trajectory is low due to design and administrative controls. Formal operational safety procedures have been prepared for the facility as a whole; these are supplemented for the unique requirements of individual tests and are reviewed by the Hazards Control Department. All explosives are handled, transported, and test fired following these procedures. All work with radioactive and toxic materials conforms to established health and safety guidelines. Additional restrictions are imposed during the grass fire season (LLNL 2001ao).

Personnel safety is enhanced by positive key control of the various phases and aspects of the operation, including the enabling of the firing console. Personnel are excluded from areas of x-ray flux by fences, barriers, and interlocked access doors and gates. Equipment is electrically isolated from the shot assembly until personnel are under cover. A muster is used for positive control of personnel access to the test area (LLNL 2001ao).

Following the shot, personnel are not allowed to enter the firing table area until specific conditions are met, including waiting for prespecified periods of time in case of malfunction or misfire. Appropriate personal protective equipment is used to re-enter the firing table after experiments involving hazardous materials. Water may be used to put out fires on the table and minimize dust production. Finally, table gravel is changed if the beryllium and radioactivity levels are above the derived working limits: 500 micrograms per gram for beryllium, 5,000 picocuries per gram for alpha emitters, and 10,000 picocuries per gram for beta or gamma radiation (LLNL 2001ao).

Generated Wastes and Effluents

The firing table debris consists of gravel and fragments of wood, metal, and glass; larger debris consists of tent poles, wood, steel, aluminum, concrete, plastic, glass, burlap bags, cables, and other inert testing materials. These wastes may be contaminated with low levels of depleted uranium and thorium. Small amounts of lead, beryllium, copper, barium, and vanadium may also be present (LLNL 2001ao). In the past, tritium was a contaminant at this facility, but tritium experiments will be discontinued at this facility in the future (LLNL 2003i). Typical wastes would include alkaline and acid solutions, including lab-packed solutions; lab-packed waste chemicals; nonhalogenated organic solutions; empty containers; debris such as contaminated paper and rags, protective clothing, and other test debris contaminated with explosives and other hazardous constituents; wastewater; cleaning solutions, including solvents; and contaminated equipment (LLNL 2001ao).

The firing table debris is characterized to segregate the low-level radioactive waste from chemically hazardous waste. The former is placed in containers and transported to the Building 804 waste staging area. All hazardous wastes (nonexplosive-contaminated) are transported to Building 883 for storage prior to shipment to Livermore Site for treatment or disposal at offsite locations (LLNL 2001ao).

A.3.2.21 *Building 851*

The Hydrodynamics Test Facility, Building 851, is part of the explosive test facility operations. This 13,681-gross-square-foot complex is in the northwest quadrant of the site and houses a LINAC, a laser room, several laboratories, a portable x-ray room, several shop areas, and offices (LLNL 2001ao).

Building 851 includes an open-air firing table of gravel-covered pads with stands of concrete, wood, or steel. During an experiment, an explosive device is placed on the test stand and fired. The firing debris may consist of wood, plastic, wiring, and gravel. The debris is potentially contaminated with unexpended explosives, beryllium, and depleted uranium (LLNL 2001ao).

Building 851 is equipped for the radiography of explosives devices during intentional detonation testing, including high-speed rotating-mirror cameras; optical interferometry for precise, free-surface velocity measurements; electronic pin timing diagnostics; and various other photoprocessing operations that involve both manual and automatic film and paper developing (LLNL 2001ao).

Hazards Assessment

The common hazards associated with the firing facilities are handling and firing explosives, high voltages, toxic and radioactive materials, high levels of ionizing radiation, firing malfunctions and misfires, grass fires, lasers, cranes and machine tools, and high pressure systems (LLNL 2001ao).

The hazards associated with the photoprocessing operations are laboratory reagents, photochemicals, and chemicals in spent developers, fixers, and rinsewaters. When film is processed, the developers and fixers are automatically replenished; and the generated waste is captured in separate barrels (LLNL 2001ao).

The hazard associated with the high-speed photographic equipment is use of high-speed rotors. Some camera rotors are made of beryllium; if these rotors are allowed to revolve at too high a speed, they will come apart, causing damage and scattering parts of the beryllium rotor around the camera room (LLNL 2001ao).

Formal operational safety plans have been prepared for the facility as a whole; these are supplemented for the unique requirements of individual tests and reviewed by the Hazards Control Department. All explosives are handled, transported, and test fired strictly following these procedures. All work with radioactive materials and with toxic materials conforms to established health and safety guidelines. Additional restrictions are imposed during the grass fire season (LLNL 2001ao).

Personnel safety is enhanced by positive key control of the various phases and aspects of the operation, including the enabling of the firing console. Personnel are excluded from areas of x-ray flux by fences, barriers, and interlocked access doors and gates. The interferometer room is also interlocked. Equipment is electrically isolated from the shot assembly until personnel are under cover. A muster is used for positive control of personnel access to the test area (LLNL 2001ao).

Following a shot, personnel are not allowed to enter the firing table area until specific conditions are met, including waiting for a prespecified period of time in case of malfunction or misfire. Appropriate personal protective equipment is used to re-enter the firing table after experiments involving hazardous materials. Water may be used to put out fires on the table and minimize dust production. Finally, table gravel is changed if the beryllium and radioactivity levels are above the derived working limits: 500 micrograms per gram for beryllium, 5,000 picocuries per gram for alpha emitters, and 10,000 picocuries per gram for beta and gamma radiation (LLNL 2001ao).

Generated Wastes and Effluents

The firing table debris consists of gravel and fragments of wood, metal, and glass; larger debris consists of tent poles, wood, steel, aluminum, concrete, plastic, glass, burlap bags, cables, and other inert testing materials. These wastes may be contaminated with low levels of depleted uranium and thorium. Small amounts of lead, beryllium, copper, barium, and vanadium may also be present (LLNL 2001ao). In the past, tritium has been a contaminant at this facility and it will continue to be so in the future (LLNL 2003i).

The firing table debris is characterized to segregate the low-level radioactive waste from chemically hazardous waste. The former is placed in containers and transported to the Building 804 waste staging area. All hazardous wastes (nonexplosive-contaminated) are transported to Building 883 for storage prior to shipment to Livermore Site for treatment or to offsite disposal facilities (LLNL 2001ao).

The photoprocessors automatically develop and fix film, and the waste generated is captured in separate barrels. This hazardous waste is taken from the barrels to the containers at the satellite accumulation area outside of the building. These containers are inspected weekly and properly labeled. These wastes in containers are temporarily stored in this area and transferred by RHWM to the Livermore Site for treatment and/or disposal at offsite facilities (LLNL 2001ao).

A.3.2.22 *Building 854 Complex*

The Dynamic Test Complex, Building 854, is in the southwest quadrant of Site 300. This 11,216-square-foot complex consists of 10 buildings, 854A through 854H, 854J, and 854V, originally designed for the vibration and physical shock testing of assemblies containing hazardous materials at various temperatures. During its operating life, a variety of materials were tested in this complex, including explosives, natural uranium, depleted uranium, thorium, beryllium in metallic form, and fissile and other radioactive materials (LLNL 2002j).

Buildings in the complex, with the exceptions of Buildings 854A, H, and V, are inactive or used as industrial storage while awaiting demolition. Current operations at these facilities (Buildings 854B-G, J) consist of monitoring and surveillance activities (LLNL 2002j). Building 854A, H, and V (2,458 square feet, 3,184 square feet, and 500 square feet, respectively) currently are used as part of the Site 300 Response Training Facility. LLNL conducts emergency response exercises at Site 300, which simulate field-implemented weapon disarmament. Explosives training devices are assembled in Building 854H. The setup and firing of explosives systems is done by qualified DoD explosive ordinance disposal personnel under the observation of a limited number of LLNL personnel who are familiar with Site 300 safety controls and procedures.

Hazards Assessment

General industrial hazardous operations in this facility are associated with decommissioning powered equipment and include solvents, oils, regulated metals, and compressed gases (LLNL 2002j). Building 854H hazards include exposure to explosive assemblies. The exercises use a number of Site 300 facilities in their current configuration. Minor modifications involving the construction of fences within and around Building 854H would be required for training activities (DOE 2002n).

Generated Wastes and Effluents

Hazardous waste and nonhazardous waste produced during decommissioning of the machine shop include spent halogenated and nonhalogenated solvent solutions (both organic and inorganic), petroleum and mineral-based oils, empty containers, metal filings, and contaminated equipment (LLNL 2002j). No wastes are associated with the explosives training facility.

A.3.2.23 *Building 857*

The Materials Management Storage Facility, Building 857, is in the southwest quadrant of Site 300. This 440-gross-square-foot facility is used to store explosives and explosive assemblies that may contain depleted uranium, thorium, and mock explosives (LLNL 2000u).

Hazards Assessment

The explosives are properly packaged and monitored by periodic inspections. There is no compatibility problem in this facility because the explosives and detonators are not stored together, and only explosives of the same storage group are allowed to be stored together (LLNL 2000u).

Safety features in this building include alarms and warning signs. The cell doors are secured by combination locks and have alarms. Access to the cells is limited to authorized personnel (LLNL 2000u).

Generated Wastes and Effluents

This facility is used for the long-term storage of explosives and explosives assemblies, and there are no operational-generated wastes or effluents. Occasionally, maintenance and support activities generate waste.

A.3.2.24 *Building 883*

The RHWM Container Storage Facility, Building 883, is located in the southeast quadrant of Site 300. This building consists of two sections. The southern section of the building is a RCRA-permitted facility, which consists of a fenced, covered area measuring approximately 1,733 square feet and surrounded by a concrete berm. Building 883 is used to store nonexplosive, nonradioactive hazardous wastes from generator facilities within Site 300. The northern section of Building 883 houses a waste accumulation area. The waste accumulation area is used to accumulate waste for up to 90 days for characterization and/or repackaging. In addition to the waste allowed in the permitted facility, the waste accumulation area will accept some radiological materials, radioactive and mixed waste, improperly packaged waste or waste in damaged containers, and improperly characterized waste. Generators identify and package waste and then transfer it to Building 883 where it is stored prior to shipment to the Livermore Site or offsite for disposal (LLNL 2001av).

Hazards Assessment

The hazards at this facility involve personnel exposures to hazardous materials including aqueous wastes, flammable liquids, acids, caustics, oxidizers, flammable solids, other toxic materials, and PCB-contaminated materials. There are no radioactive wastes stored in the *Resource Conservation and Recovery Act*-permitted southern section of this facility (LLNL 2001aj).

Generated Wastes and Effluents

This facility stores wastes generated at Site 300 facilities. Typical stored wastes include acids (liquids), asbestos, combustible liquids, compressed gases, flammable liquids, halogenated and nonhalogenated solvents, lab packs, laboratory debris (solids), mercury and mercury-contaminated waste, miscellaneous chemical waste and contaminated debris, mixed waste (liquid/solid waste containing both hazardous and radioactive constituents), oils (liquid/solid), PCBs (liquid/solid), paints (liquid/solid), photochemicals, liquid poisons, radioactive waste (liquid/solid), reactive materials, and wastewaters (LLNL 2001av).

A.3.2.25 *Explosives Storage Magazines*

All explosives at Site 300 are stored in vaults or bunkers called magazines or magazettes. There are about 60 magazines located throughout the site, with floor areas typically ranging from 50 to 500 square feet.

A magazine is defined as an approved structure specifically designed for the storage of explosives, excluding operating buildings. A storage magazine is used for the long-term storage of bulk explosives and assemblies. A service or ready magazine is used for short-term (maximum of 180 days) storage of explosives and assemblies currently being used in an operation. A magazette is a small magazine (not large enough for an entry) used to store explosives that require separate storage (LLNL 2000u).

In addition to these storage magazines, a laboratory or building may contain a storage vault, which is typically a locked room or cabinet, for short-term storage of explosives that are currently being used in the operations (LLNL 2000u).

Hazards Assessment

Proper packaging, explosives deterioration, and chemical compatibility are the major areas of safety concern. Packaging is monitored by periodic inspection of the magazines compatibility problems are controlled by assignment of explosives into storage compatibility groups and the storage review program is designed to control the use of explosives that have deteriorated (LLNL 2000u).

Each magazine has an associated weight limit, and the weight limit signs are posted near the entrance to the magazine. An inventory record is kept for each magazine and reflects the actual weight stored in the magazine. Storage magazines are inventoried once every 6 months and service magazines are inventoried every 3 months to verify that the weight of their contents is equal to or less than the posted weight limits (LLNL 2000u).

The safety and operational controls are described below (LLNL 2000u).

- Explosive assembly components are the only materials stored in the magazines.
- Propellants containing nitrocellulose vary widely with respect to stability, and the decomposition of some may lead to incidents of spontaneous ignition. There is a special surveillance system program for these propellants. One sample from each lot or batch is designated as a control item and is inspected annually. Deteriorated propellants are sent to disposal.
- Explosives devices such as actuators, detonators, squibs, and ammunition are never retained beyond the manufacturer's recommended shelf life.
- No smoking is permitted in the magazine area out to a distance of 50 feet.
- Most magazines are vented. Some magazines may require air conditioning or special ventilation systems to reduce deterioration of explosives due to hot, stagnant conditions. For safety reasons air conditioning is also used in some instances to prevent overheating.
- Empty explosives containers must be marked as empty, but may not be removed from the magazines. Packaging materials such as wood and paper are handled as explosives-contaminated waste and are removed from the magazine.
- The magazine areas are equipped with emergency telephones. There are posted personnel limits for each magazine area and only qualified personnel are allowed.

Generated Wastes and Effluents

The magazines are used for storage of explosives and explosive assemblies; no explosive wastes are generated in them. Only small quantities of packaging materials are handled as explosives-contaminated wastes.

A.3.2.26 *High Explosives Rinsewater Surface Impoundment Ponds*

Two connected surface water impoundments are in the southeast quadrant of Site 300. These impoundments were constructed in response to a Central Valley Regional Water Quality Control prohibition against discharge of nonhazardous rinsewaters to the ground surface or to unlined basins (LLNL 2002ap). Wastewater generated in Buildings 806, 807, 809, 817, and 829 passes through filter bags, a conical clarifier, a settling basin, and a weir before entering the surface impoundments (LLNL 2000z). The impoundment ponds are comprised of an upper and lower pond that together comprise approximately 42,000 square feet. The basins are lined with 2 feet of clay and a 60-mil thick, high-density polyethylene synthetic liner (LLNL 2002ap). A leachate collection and removal system, installed between the high-density polyethylene liner and the clay liners, allows the system to be monitored for leaks (LLNL 2002cr). Process and photo rinsewater from the process area, chemistry area, and B-Division firing areas are also discharged into the surface impoundments (LLNL 2002ap).

Hazards Assessment

The major hazards associated with the impoundments are slips and falls and natural hazards such as rattlesnakes, scorpions, spiders, etc. (LLNL 2002ap).

Generated Wastes and Effluents

Typically, no waste is generated at the surface impoundments. However, the liners are nearing the end of their predicted life span and will be replaced, probably during calendar year 2004. Replacing the liners will result in removal of the sludge, recently characterized as nonhazardous, as well as the old liners (LLNL 2002ap).

A.3.2.27 *Security, Medical, and Emergency Response Facilities and Services*

The security, medical, and emergency response facilities are in the southeast quadrant of Site 300. Building 882 (4,912 gross square feet) houses the Protective Services Division communication center. Building 889 (2,709 gross square feet) houses the badge office and the medical center, which provides services including physicals, blood tests, and record keeping. Building 890 (6,752 gross square feet) houses the Site 300 Fire Department, which not only provides services to the 11-square-mile test site, but also responds to emergencies along Corral Hollow Road and surrounding regions under mutual aid agreements. The Fire Station also provides decontamination facilities that are shared with Building 889 (DOE/UC 2000).

Biomedical wastes generated from the medical facility include needles, syringes, gauze, gloves, and other materials that could be contaminated with infectious agents. These wastes are transported to BBRP at Building 361 for autoclaving. Spent alcohols are also generated. All wastes are handled by RHWM for proper disposal. The LLNL emergency response capabilities for the Livermore Site and Site 300 are described in Appendix I.

A.3.3 No Action Alternative, Site 300

This section describes the projects and programs under the No Action Alternative for Site 300. Projects required to maintain the existing infrastructure, such as building maintenance, minor modification to buildings, general landscaping, road maintenance, and similar support activities, are part of the No Action Alternative and are described here. Operational modifications to existing projects, projects involving new facilities or maintenance, and major deactivation and D&D projects are summarized in Table A.3.3–1. Figure A.3.3–1 shows the locations of these projects. A list of all D&D projects at Site 300 is provided in Table A.3.3–2.

TABLE A.3.3–1.—*Site 300 Program Projections*

No Action Alternative		
Site 300 Revitalization Project	N/A	b
Site 300 Wetlands Enhancement	N/A	N2
Site 300 Tritium Use	N/A	b
Site 300 as a Response Training Facility	N/A	N3
Site Utilities Upgrade (SURUP)	N/A	b
Remove and Replace Offices	a	b
Deactivation, Decommissioning, Demolition	20,202	c
Proposed Action would include the following projects in addition to the No Action Alternative projects		
High Explosives Development Center	23,000	P1
Energetic Materials Processing Center	40,000	P2
Deactivation, Decommissioning, Demolition	109,333	c
Reduced Operation Alternative would affect the following project		
Reduce number of hydroshots at S300	N/A	b

Source: Original.
[a] 20,000 square feet per year.
[b] several site-wide locations.
[c] See Table A.3.3–2 for Site 300 Deactivation, Decommissioning, and Demolition projects.

TABLE A.3.3–2.—*Site 300 Deactivation, Decommissioning, and Demolition Projects (continued)*

Facility Number	Facility Name	Square Feet	Waste Generation (LLW, MLLW, transuranic, solid sanitary waste, etc.) (tons)
828A	Inactive	212	NA
828B	Inactive	199	NA
828C	Inactive	258	NA
832F	Storage	2,995	1.4975
854A	Response training	2,458	1.229
855A	Disassembly facility	685	0.3425
855B	Disassembly facility	637	0.3185
855C	Disassembly facility	612	0.306
856	Industrial storage	1,484	0.742
858	Drop tower complex	1,460	0.73
858A	Storage	865	0.4325
865	Advanced test	60,318	30.159

Source: DOE 2003b.
HE = high explosive; LINAC = LLNL Electron-Positron Accelerator; LLW = low-level waste; MLLW = mixed low-level waste; NA = Not available. Data will be in separate NEPA documentation for the facility.

A.3.3.1 *Site 300 Revitalization Project*

Site 300's infrastructure was revitalized in the 1990s. The project was essential to provide the needed infrastructure to support LLNL programs such as stockpile stewardship. The Site 300 revitalization project included improvements to the main entrance and the heavily traveled roads going up to the firing areas and construction of the automated central control post. The revitalization project also included upgrades to the flash x-ray radiographic machine, the many beam velocimeter, and other related hydrotest diagnostics.

The final phase of the Site 300 revitalization project involves improvements to the water system by establishing a connection and line extension to the San Francisco Hetch Hetchy aqueduct. Onsite water pipelines have been extended and upgraded and are currently waiting for the distribution of water to begin (LLNL 2000a).

A.3.3.2 *Site 300 Wetlands Enhancement Project*

Continued operations at Site 300 would remove up to 0.62 acre of wetland habitat. LLNL would mitigate the 0.62-acre artificial wetland removal by protecting and enhancing selected areas and increasing breeding opportunities for the California red-legged frog and California tiger salamander. A minimum of 1.86 acres; i.e., a 3:1 replacement ratio, of wetland habitat would be enhanced and managed for these two species. Two mitigation sites for enhancement would include the wetlands at Mid Elk Ravine near the Building 812 complex and the seep at the Super High Altitude Research Project (SHARP) Facility, Building 865. A third site, the Oasis, is designated for set-aside and monitoring.

A.3.3.3 *Site 300 as a Response Training Facility*

LLNL would conduct emergency response exercises at Site 300 that would simulate field-implemented weapon disarmament. Explosives training devices would be assembled in Building 854H. Setup and firing of explosives systems would be done by qualified DoD explosive ordinance disposal personnel under the observation of a limited number of LLNL personnel who are familiar with Site 300 safety controls and procedures. The exercises would use a number of Site 300 facilities in their current configuration. Minor modifications involving the construction of fences within and around Building 854H have occurred (DOE 2002n).

A.3.3.4 *Site 300 Tritium Use*

Each facility could have 20 milligrams of tritium resulting in a credible release scenario of this amount. The need to perform several intentional detonation experiments with a few micrograms of tritium and a small number of experiments with a few milligrams of tritium is anticipated and serves as the basis for the annual emissions value of 20 milligrams. This annual emissions value is considered a maximum amount. The actual emissions may vary widely depending on the specific experiments needed to support the programmatic mission.

In addition, as part of the No Action Alternative, LLNL would suspend the performance of all tritium experiments at Buildings 812 and 850. Because experiments that do not contain tritium would likely contain other radioisotopes, no reduction in the level of other low-level radioactive waste generated is anticipated.

A.3.3.5 *Site Utilities Upgrade*

Significant replacements and life extension improvements (over and above normal repair by replacement) would be required for LLNL’s utility systems at Site 300. The scope of the project would include various upgrades to mechanical utilities including upgrades to the Site 300 heating and cooling systems, potable water system, and a transmission line looping system at Site 300. Asbestos-containing building materials would also be addressed by the implementation of an asbestos management program which would include surveying buildings and structures, removing damaged asbestos-containing building materials discovered during the surveys, and as-needed asbestos abatement (DOE 2003b).

A.3.3.6 *Remove and Replace Offices*

This project would consist of the removal, relocation, and replacement of temporary facilities. These facilities consist of trailers and modular units that house temporary offices. The facilities would be replaced by modular or permanent structures in previously developed areas and would include site preparation and construction of new parking areas or improvement to existing parking areas.

Land disturbance associated with the demolition and new construction would be minimal. Sites would be evaluated for archaeological and biological impacts prior to, and in the case of, potential archaeological impacts during new construction activities. Debris from the demolition and construction process would be handled and disposed of (or recycled, if appropriate) in accordance with established LLNL procedures.

A.3.3.7 *Deactivation, Decommissioning, and Demolition Projects*

This project would D&D 14 excess facilities at Site 300, encompassing 20,200 gross square feet. Facility deactivation could include disposition of stored or surplus materials that may be potentially contaminated. These materials and equipment are designated as legacy items, meaning there is no identified sponsor or program. Most legacy materials are materials that were placed in storage or set aside for a future need that never materialized.

Deactivation support activities could include material abatement, characterization, spot decontamination, material containment, spill cleanup, waste packaging, and disposal. Buildings that are obsolete and too expensive to rehabilitate would undergo demolition. The demolition effort would include electrical and mechanical isolation from the LLNL utility grid; sampling for contamination, characterization, and proper disposal of all subsystems and components; and dismantling and disposal of the structures. Where feasible, building materials that could be recovered would be segregated and transported offsite for recycling.

The list of excess facilities, including gross square footage and estimated waste generation, is provided in Table A.3.3–2.

A.3.4 Proposed Action, Site 300

The Proposed Action at Site 300 would include the projects and programs described under the No Action Alternative (Section A.3.3) and the additional projects and programs described in this section. Planned projects and programs are listed in Table A.3.3–1. Figure A.3.3–1 shows the locations of these projects.

A.3.4.1 *High Explosives Development Center*

The High Explosives Development Center Project would construct approximately 23,000 square feet of new buildings and renovate the existing Building 827 complex located in the south-central section of Site 300. This project would consolidate operations currently conducted in Buildings 825 and 826 and the Building 827 complex. Operations and equipment would include mechanical pressing; vertical temperature-controlled mixers for mixing explosives binders, plasticizers, and other compounds; a 50-cubic-inch deaerator loader for processing the extrudable explosives; vacuum ovens for drying materials; mills for reducing particle sizes; a loader for processing extrudable explosives; blenders and kettles for preparing explosives; an environmental chamber and associated control and interlock modules; electrical resistance measurement devices; a gas sampling oven; and a computer system (DOE 2003b, LLNL 2002ap).

A.3.4.2 *Energetic Materials Processing Center Project*

Existing energetic materials processing facilities and equipment at Site 300 are becoming obsolete and inadequate to meet LLNL requirements. This project is intended to move the operations currently conducted in Buildings 805, 806, 807, 810A-C, 813, and 823A-B into a new modern facility. The Building 810A-C complex would be retained for some assembly operations currently conducted there and for waste package operations currently conducted in Building 805. All other facilities would be demolished (see Section A.3.4.3). The proposed Energetic Materials Processing Center (EMPC) would be located at the Site 300 process area in the vicinity of the Magazine 21-24 loop. The project would include the construction of a new 40,000-gross-square-foot processing facility and four magazines, two capable of storing 1,000 pounds of high explosives and two capable of storing 500 pounds of explosives. The EMPC would house explosives machining, pressing, assembly, inspection, and radiography. Additionally, the facility would provide a machine shop, offices, storage, showers/change room facilities, equipment rooms, and miscellaneous support spaces (LLNL 2002ap).

Because the EMPC would replace certain functions in Buildings 805, 806, 810A-C, 813, and 823A-B, impacts from EMPC operations would be similar to those from existing operations in those buildings. For example, the facilities that EMPC would replace have approximately 7 employees. The EMPC would have 7 to 10 employees. Process water consumption would consist primarily of water sprayed on explosives during machining and washdowns, which would be similar to current usage in the process area facilities. Electric power consumption could decrease slightly from current levels as a result of energy conservation measures that would be designed into the new facility. Impacts to other environmental resource areas as a result of EMPC operations would remain unchanged. The facility design and operation would include careful attention to Federal, state, and local environmental laws and regulations.

Construction of the EMPC would occur over a period of approximately 2 years and would employ approximately 75 workers during peak construction periods. Site improvements would include clearing and grading approximately 2.5 acres of grassland for the building, magazines, roadways, and parking area. Existing utilities would be extended approximately 2,500 feet to the new building. The extension of utilities would involve minor trenching. Construction debris and any excess soils would be analyzed and disposed of in accordance with Federal, state, and local regulations, applicable DOE Orders, and LLNL procedures.

Construction activities would result in short-term impacts to air quality in the form of fugitive dust and emissions from construction equipment and motor vehicles. General construction practices at Site 300, including contract specifications, would require that fugitive emissions be reduced by means such as water spraying of roads and the wheels and lower portions of construction vehicles and covering exposed piles of excavated material. Thus, application of periodic water spray would mitigate, to the extent feasible, the potential impact of fugitive dust generated during the EMPC construction on ambient air quality at Site 300.

Noise levels to both onsite and offsite populations would not be increased by the construction activities. Workers involved with the EMPC construction would wear appropriate hearing protection when necessary.

The proposed EMPC construction site would not be located within or near any identified wetlands area or 100-year floodplain. Best management practices appropriate for site conditions would be followed during construction to prevent the transport of disturbed soils or construction materials from the construction site.

Preconstruction surveys for threatened and endangered species would be conducted within 60 days prior to ground-disturbing activities. Depending upon the results of the survey, mitigation measures such as the establishment of exclusion zones, would be implemented to protect any observed species.

No known cultural resources are located within the proposed construction area. Any subsurface cultural resources that could be unearthed during construction activities would be reported to the LLNL archaeologist. Construction activities within the vicinity of the find would be halted until the find is assessed and any necessary mitigation measures are developed in consultation with DOE, the State Historic Preservation Office, and the Advisory Council on Historic Preservation.

Normal construction hazards would be present during the construction phase for the proposed action. Workers would receive proper safety training prior to construction, and all activities would be in accordance with all relevant *Occupational Safety and Health Act* requirements. The results from the preconstruction sampling would determine if worker protection measures would be required. These would consist of approved LLNL procedures that govern work in areas of known contamination to minimize worker exposure and prevent the tier spread of contamination from excavation activities.

A.3.4.3 *Deactivation, Decommissioning, and Demolition Projects*

This project would D&D 50 excess facilities at Site 300, encompassing 129,535 gross square feet of floorspace, including 20,200 square feet under the No Action Alternative. Facility deactivation could include disposition of stored or surplus materials that may be potentially contaminated. These materials and equipment are designated as legacy items, meaning there is no identified sponsor or program. Most legacy materials are materials that were placed in storage or set aside for a future need that never materialized.

Deactivation support activities could include material abatement, characterization, spot decontamination, material containment, spill cleanup, waste packaging, and disposal. Buildings that are obsolete and too expensive to rehabilitate would undergo demolition. The demolition effort would include electrical and mechanical isolation from the LLNL utility grid; sampling for contamination, characterization, and proper disposal of all subsystems and components; and dismantling and disposal of the structures. Where feasible, building materials that could be recovered would be segregated and transported offsite for recycling.

The list of excess facilities, including gross square footage and estimated waste generation, is provided in Table A.3.3–2.

A.3.5 Reduced Operation Alternative, Site 300

The following project would be curtailed under the Reduced Operation Alternative. This would be a change to the baseline operations described under the No Action Alternative. The project is summarized in Table A.3.3–1.

A.3.5.1 *Reduce Number of Hydroshots at Site 300*

Under the Reduced Operation Alternative, NNSA proposes to perform fewer intentional detonation experiments at Site 300 firing tables or the Building 801 Contained Firing Facility, resulting in a reduction of both hazardous and radioactive materials including tritium. This would result in a reduction in the maximum annual tritium emissions from 200 curies to 150 curies. Other types of experiments such as environmental testing of explosives assemblies would continue unchanged in the number of experiments and amounts of tritium. The programmatic impacts of this alternative could include having less confidence in the evaluation of two types of component functions within weapon systems.

A.4 RADIOACTIVE MATERIALS AND CHEMICAL INVENTORIES—LIVERMORE SITE AND SITE 300

Radioactive and chemical inventory data for the Livermore Site and Site 300 are listed in Table A.4–1 through Table A.4–6. Emission rates are listed in Tables A.4–7 and A.4–8.

Waste and inventory data include:

- Radioactive materials inventories for the selected facilities (Tables A.4–1 and A.4–2)
- Chemical inventories for the selected facilities (Tables A.4–3 and A.4–4)
- Estimated emission rates, based on 2001 fuel use (Tables A.4–5 and A.4–6)
- High explosives, maximum quantities – 100,000, annual facility average quantities – 15,000 pounds, facility locations LLNL-wide.

The inventory data listed in Tables A.4–1 through A.4–6 represent only the selected facilities described in this appendix. The tables show typical quantities rather than maximum limits. These chemicals and radioactive materials are subject to change as LLNL experimental requirements change. Additionally, the chemical inventory data presented in this appendix for both sites were reduced from an extensive list and were limited to extremely hazardous chemical quantities greater than 1 pound and all other chemical quantities greater than 500 pounds present in these selected buildings. Therefore, some chemicals listed in the building descriptions may be used in smaller quantities and may not appear in the tables. Figures A.4–1 and A.4–2 show waste management facilities at the Livermore Site and Site 300, respectively.

TABLE A.4–1.—*Radionuclide Inventories[a] for Selected Livermore Site Facilities (continued)*

Building Number	Radionuclide	Approximate[c] Quantity or Limit (kg, lb, or Ci)	Status[d]
RHWM Facilities (Area 514)	Miscellaneous radionuclides	Inventory maintained below Cat 3 thresholds	Radiological facility
RHWM Facilities (Area 612)	Cat 2 radionuclides	See Appendix B for inventory limits	Category 2 facility
DWTF Buildings 695/696S	Cat 3 radionuclides	See Appendix B for inventory limits	Category 3 facility
DWTF Building 693/ 696RWSA	Cat 2 radionuclides	See Appendix B for inventory limits	Category 2 facility
Cargo Container Testing facility (planned)	Depleted or natural uranium	50 kg	Radiological facility
	Uranium-235		
	Plutonium-239	1.0 kg (metal), 0.2 kg (oxide)	
	Sealed sources	0.40 kg	
		Inventory maintained below Category 3 thresholds	

Source: LLNL 1999b, g; LLNL 2000d, k, l, o, p; LLNL 2001b,e, f, aw; LLNL 2002ar, cq, co.
[a]Summary information, additional details are provided in Appendix B. Numbers may be rounded.
[b]Ratio of activity to Category 3 threshold must be below 0.8 in order for a radiological accident analysis to not be required in a hazard analysis report.
[c]Inventories are snapshots in time. The information is provided to give the reader a degree of scale and is not (unless otherwise stated) a limit.
Category 2 – Hazard analysis shows the potential for significant onsite consequences. Category 3 – Hazard analysis shows the potential for only significant localized consequences. Radiological–Facilities that do not meet or exceed Category 3 threshold criteria but still possess some amount of radioactive material. Category 2 and Category 3 thresholds are defined in DOE Standard DOE-STD-1027-92 (DOE 1997d).
[e]Administrative limit.
[f]Materials in Buildings 331 and 334 are within the Superblock Administrative Limits for plutonium and uranium.
Ci = curies; DWTF = Decontamination and Waste Treatment Facility; kg = kilograms; RHWM = radioactive and hazardous waste management; RWSA = radioactive waste storage area.

TABLE A.4–2.—Radionuclides Inventories[a] for Site 300 Facilities

Material	Use	Approximate Quantities[b]
Depleted uranium	Assembly	4.2 Ci
	Components	10,640 kg
Thorium-232	Assembly	01 Ci
	Components	910 kg
Tritium	Assembly	193 Ci
	Components	20 mg

Source: LLNL 2002l.
[a] Inventories are snapshots in time. The information is provided to give the reader a degree of scale and is not (unless otherwise stated) a limit.
[b] Approximate quantities are for each authorized facility.
Ci = curies; kg = kilograms; mg = milligrams.